LIBRARY OF CONGRESS
FEB 12 1900
SMITHSONIAN DEPOSIT

THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXII. No. 7. Whole No. 1,288. | NEW YORK, MONDAY, FEBRUARY 12, 1900. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
Thirtieth Annual Meeting of the New England Association of Gas Engineers 241
Seventh Annual Meeting, Michigan Gas Association 242

EDITORIALS—
Briefly Told 242
The Eighty Cent Gas Rate for Haverhill, Mass.—Notes.

*A De Brouwer Coke Conveyor and a Carburetted Water Gas Plant at the Crystal Palace Gas Works 242

The Recovery of Nitrogen in Coal Distillation, by Messrs. C. W. Anderson and James Roberts—Concluded from Page 210 246

The Semet-Solvay Coke Plant at Dunbar, Pa., by Mr. Wm. L. Affelder 249

The Future of Electric Illumination—Part V.—By Mr. Jean Wetmore—Concluded from Page 208 250

The Economies of Long Distance Electric Power Transmission, by Mr. Alton D. Adams 251

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 252

A Budget from "Observer"—Death of Mr. George A. Stearns—Annual Meeting, Le Roy, N.Y.—Mr. Hintze Makes a Correction—Cheaper Gas for Bloomfield and Montclair, N. J.—Improvements on the Philadelphia, Pa., Gas Plant—A Hint from Bremen, Germany—The Lexington (Mass.) Company May Increase Its Capital—To Extend the Columbus, Ind., Franchise—Proposing to Decrease the Gas Rate, Richmond, Va.—Something from Freeport, Ills.—Personal, Mr. A. P. Lathrop—Annual Meeting, Houston, Texas—Proposed Gas Works for Manchester, Va.—Mr. Ritter Succeeds Mr. Lathrop—Proposed Gas Works for Clinton, Ills.—The Cleveland Gas and Illuminating Company—Report of Gas Inspector for Louisville, Ky.—And Other Items.

The Market for Gas Securities 254

[OFFICIAL NOTICE.]

Thirtieth Annual Meeting of the New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Feb. 6, 1900.

To the Members of the New England Association of Gas Engineers: The Thirtieth Annual Meeting of the Association will be held at Young's Hotel, Boston, on Wednesday and Thursday, February 21st and 22d. The call to order will be made at 10 A.M.

Members will please gather promptly in the meeting room (No. 12), so that the sessions may not be delayed.

The following papers are to be read:

"Then, Now and Later;" by Mr. John A. Waters, Stamford, Conn.

"Four Years' Experience with Prepayment Meters;" by Mr. N. O. Goulding, Natick, Mass.

"Pumping Gas Five Miles, at 20 Pounds Pressure;" by Mr. F. H. Shelton, Philadelphia.

"Some Notes on Oil and Tar Burners;" by Mr. B. J. Allen, Allston, Mass.

The Question Box content so far is as follows:

"What successful substitute for cast iron gas mains has the high price of iron developed?"

"Would a gas inspector be justified in 'passing' a job that had been made tight through healing a leak by cold water application?"

"Are wrought iron or steel tanks set on surface of ground considered better than brick and cement, or stone or cement tanks set in the ground, for gasholders? And is there much difficulty in the construction of the latter to prevent leakage?"

"In double stacks of retorts, which arrangement is preferable: To have the benches set back-to-back, or facing each other, with operating floor between?"

"At what price can gas be produced by any of the acetylene gas machines?"

Topics suggested for discussion are:

"Coke Oven and Retort House Construction and Results."

"Under-water Gas Main Construction."

Eminent gas engineers and constructors have consented to start discussion on the named topics.

Members are urged to send in their questions for the Box well before the meeting, that they may be published, thus giving all a chance to join intelligently in one of the most useful features of the meeting.

It is suggested that members wear their badges at the meeting. Badges may be secured from the Treasurer.

The members will dine together as usual on Wednesday evening. Blank applications for membership may be obtained of the Secretary, and all matter to come before the Directors should be forwarded to the Secretary, not later than February 20th.

Friends of the Association are invited to attend the meeting.

N. W. GIFFORD,
Secretary.

[Official Notice.]

Seventh Annual Meeting, Michigan Gas Association.

Michigan Gas Association,
Office of the Secretary,
Racine, Wis., Jan. 17, 1900.

To the Members of the Michigan Gas Association: The Seventh Annual Meeting of the Michigan Gas Association will be held in the city of Detroit, on Wednesday, the 21st, and Thursday, the 22d day of February next. Headquarters will be at the Russel House, where also the meetings of the convention will be held. Rates $3.50 and upwards per day for room with bath, and $2.50 and upwards without bath.

H. H. Hyde, Secretary.

BRIEFLY TOLD.

The Eighty Cent Gas Rate for Haverhill, Mass.—In the Journal for last week our special correspondent "Observer" put out quite plainly the facts respecting a recommendation, uttered by the Board of Gas and Electric Light Commissioners of Massachusetts, that the Haverhill Gas Light Company should, from the 1st inst., put its selling rate at 80 cents per 1,000 cubic feet. His exposition of the case is so clear that further illustrating of its features would add nothing more of thought to one who tried to identify it. However, knowing the case or not, the action of the Commissioners, as per the dominating spirit of the Commission, must be satisfactory to them and to him, in that the result of their deliberations has been an avalanche of petitions to the Legislature of the State, to the Councils of Cities, or to the whoever else that rule smaller populous centers in Massachusetts, declaring that gas rates everywhere in the State are too high—for the gas users. No doubt the residents of all the complaining districts believe that the price of meat in their respective places is too high—unless they are butchers; that flour costs are exorbitant—unless they are millers; that oil costs too much—unless they are owners of shares in the Standard Oil Company. And where may the statement of such division of thought end? Apart from such speculations, however, it would seem that the Board of Gas and Electric Light Commissioners, in listening to the woeful plaint of Mayor Chase, of Haverhill, that "his people" had for long time—in fact, until his honor had caught a rainbow—been suffering from excessive gas charges, forgot the fact that low capitalization had nothing to do with the Mayor's bid for whatever the bid was worth. If the Commission had been appealed to to restrict a proposed issue of stocks by the Haverhill Company, or whoever was about to take its property over, one could understand why such proposed capitalization might not have been agreed to in the matter of the heaviest wishes of its reorganizers; but that the Commissioners should seek to destroy the value of the original capitalization, through curtailing in great degree its earning power, in the vital sense of decreeing that its product should be sold at a price without a chance of yielding fair profit on *honest* capitalization, is beyond our scope and pen, although it may well be within those of President Barker and his associates. The plain facts in the case are that the gas rate in Haverhill was never in the history of the Company excessive, that its service was good and acceptable, that its capitalization was *low* (according to the last return of the Board of Gas and Electric Light Commissioners, the capitalization was $1.164 per 1,000 cubic feet of gas sold), and that its property, through over-conservatism, had become a bone of contention amongst those who know a good thing when they see it. In any event President Barker and his associates on the Board have the satisfaction of knowing that their Haverhill blast has awakened the howling packs of political wolves whose trot is persistent for anything gas that may come their way, even in the State or local "legislative halls" of the Bay State. Next week we will print the decision complete.

Notes.—At the annual meetings, recently held, of the Gas Company of Montgomery county, Norristown, Pa., and of the Norristown Gas and Electric Light Company, Mr. John D. McIlhenny, of Philadelphia, was re-elected President of both corporations. ——The franchise for the lighting by gas of Moorestown, N. J., has been granted to the financiers who represent the River Shore Gas Company, of Riverton, N. J. The successful ones seem to have been those who were entitled to the grant.——Mr. Daniel McNamara, for many years Superintendent and Purchasing Agent of the Lynchburg (Va.) Gas Light Company, died at his home in that city last Monday. Deceased was in his 60th year.——At the annual meeting of the New Britain (Conn.) Gas Company the following officers were chosen: Directors, James H. Eddy, A. J. Sloper, F. N. Stanley, E. N. Stanley and H. E. Russell; President, James H. Eddy; Secretary and Treasurer, A. J. Sloper.

A De Brouwer Coke Conveyor and a Carburetted Water Gas Plant at the Crystal Palace Gas Works.[1]

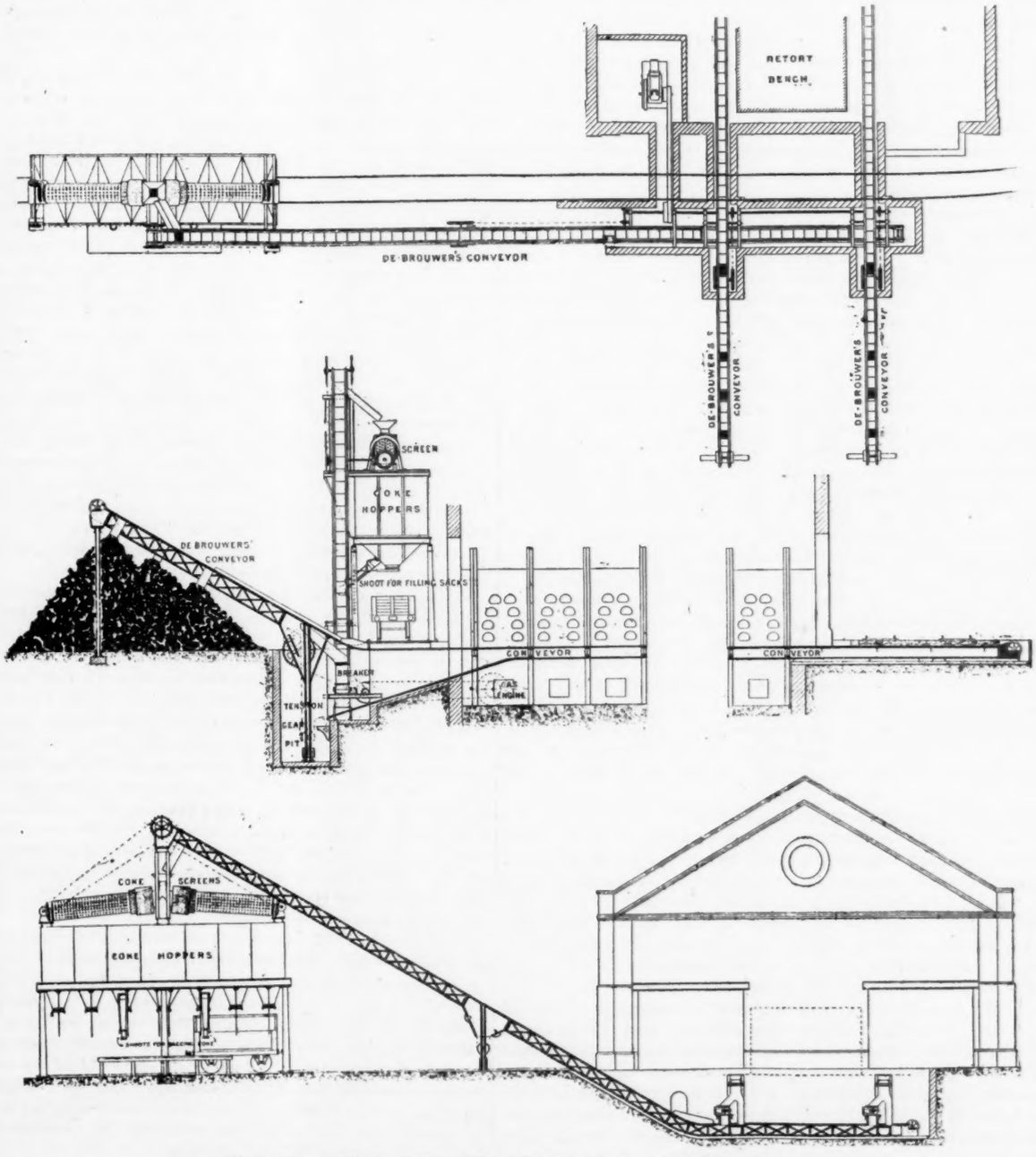
The Crystal Palace District Gas Company supply an extensive area, containing a residential population. The needs of that population, the natural depreciation to which plant must yield with time and service, the circumstances of the labor market, and the necessity of meeting expanding business with a minimum increase in manual labor, have all combined to render inevitable a large scheme of extension and improvement. It was to this work that Mr. Sydney Y. Shoubridge found it necessary to devote himself soon after his installation as Engineer of the Company; and now section by section it is being, and will be, taken in hand as occasion admits and necessitates. The preparatory plans perfected, the early part of last year witnessed the signing of the first contracts. To-day the works comprised in those contracts are practically completed—somewhat behind the stipulated time, it is true; but the fault (oft heard in many places during the past year) rests with the state of the iron and steel trade, and is not actually attributable to any remissness on the part of the contractors. The works which are now almost out of the hands of the latter consist of a complete carburetted water gas plant and a De Brouwer coke conveyor and elevator; and it is with these, and not prospective work, that the present article will deal.

The De Brouwer Coke Conveying Plant.—While from the point of view of magnitude and of capability as a gas producer the carburetted water gas plant is of foremost importance to the Company, the De Brouwer coke conveying plant—this being its first adoption in this country—possesses an interest for English gas engineers which, for the moment, overshadows the claims to attention of the more imposing water gas apparatus. Therefore, upon the coke conveyor we will first pen the information at command. It would not be news to readers of the *Journal* to be told that the merits of this conveyor have obtained for it an extensive use on the Continent; but it may be interesting to many to learn that it was the opportunity which was afforded Mr. Shoubridge of witnessing the operation of the plant at the Hague Gas Works, at the time of the visit of the Institution of Gas Engineers, that induced him to advise his Directors to adopt the De Brouwer system in preference to home invented competitors. This is a tribute to the value to English gas engineers of opportunities for investigating the work and practice of their Continental brethren. Although Messrs. Jenkins & Company, Limited, of Retford, have now been "sole makers" of this form of conveyor for a considerable time, this is the only example of the plant that has so far been erected in this country; and, had the members of the Institution not seen it at work on the Continent, it might possibly have been some time longer before the system obtained a footing in this country—gas engineers, like other human beings, having an inclination for a little ocular demonstration of the value of a thing before they invest their money in it. But now that the De Brouwer apparatus has established itself here, doubtless more will soon be heard of it—in fact, we know that several engineers of important gas works who are contemplating laying down coke conveying apparatus are delaying their plans pending the opportunity of being able to personally observe the performance of the Crystal Palace plant.

It is not many years ago that we heard it said that a really good coke conveyor, which should be a help and not a hindrance on a gas works, was a desideratum. Of late there has been quite a spurt in the equipment of retort houses with plant for automatically removing the coke; and there are at the present time, in actual operation in gas works, several examples of different makes of coke conveyors, between which it is now merely a question of the "survival of the fittest." In the De Brouwer conveyor, Mr. Shoubridge thoroughly believes that he has secured a very valuable help in facilitating the work of the retort house, and in lightening its cost. Among other points which struck him when he saw the plant in operation at the Hague works were its simplicity, and the almost entire absence of friction and rattle. The latter was rather a conspicuous and irritating feature of some of the older forms of pan conveyors, which were blessed with so many parts and so much weight that they gave endless trouble in working, and no little expense was involved in the constant replacement of worn-out portions. In this respect, the De Brouwer conveyor stands out in marked contrast; and it is Mr. Shoubridge's impression that it is destined to succeed on this very score—that there is, so far as he has been able to judge, so little wear and tear about it. Without pursuing the general subject further, we will at once proceed to describe the plant laid down at the Crystal Palace works.

1. *Journal of Gas Lighting.*

The conveyor has been constructed for dealing with the coke from No. 4 retort house. This house occupies a position in the works where the works railways narrow towards the main junction communicating with the South Eastern Railway. A double line of railway passes close to one end of the house, and a single line close to the other end. On both sides of the house, there are large coal storing spaces, and several buildings containing boilers and other machinery. The coke yard at the end where the double line is, is limited in extent by other branches of the railway passing to other portions of the works, and the space at the opposite end is only narrow on account of the boundary. The retort house floor is at the same level as the coke yard; but there is a basement below, in which the furnaces and regenerators are built. The stoking is done by means of West's compressed air machinery; and the coke has, until recently, been wheeled out to one end of the house, which is fitted with 18 beds of 8 through retorts, 20 feet long.



The De Brouwer Coke Conveying and Elevating Plant at the Crystal Palace Gas Works.

The drawings show the plant in side and end elevation and plan. The plant is designed to take the coke from each side of the retort bench, and quench it thoroughly at the end of the retort house outside. The coke from each conveyor, after having all the quenching water drained out of it on the sloping end of the conveyors, falls into a return shoot, which delivers it either to a coke breaker or direct to the horizontal part of the inclined cross conveyor, which then conveys the coke to the screens for separating the breeze and dust. Underneath the screen is placed a large storage hopper, capable of taking 24 hours' make of coke, and divided into 8 compartments, of which one holds breeze dust, another clean breeze, four others screened broken coke, and the other two large coke. By an arrangement of slides in the screens, six of the compartments can be filled with unbroken coke separated from breeze and dust. The storage hopper is supported on columns spanning the railway, and each compartment has a door at the bottom with levers, by moving which the coke can be loaded into railway wagons or carts placed underneath. The doors are of considerable size, but can be moved with the greatest ease, as they run on a simple arrangement of rollers. At one side of the supporting columns, there is a platform raised above the ground to the level of the bed of the coke carts or vans, and by means of side shoots from the conical bottoms of two of the compartments of the hopper, the coke is filled into bags, which are then taken on sack trucks, and placed in the coke vans backed up to the platform for the purpose. The bagging shoots have an arrangement at the outlet end for holding the bags open, and clips for keeping them in position. The clips act automatically, so that the bag, when slipped under them, is held fast

and gripped tighter as the load increases. A platform weighing machine is placed under each bagging shoot at the level of the platform, so that the bags can be weighed and accurately filled with the required quantity of coke.

The long sloping ends of the two retort house conveyors are for two purposes. Firstly, they provide a means of continuing the use of the retort house conveyor when the storage hopper happens to be full. This may easily occur from want of railway wagons, from a block on the railway, or on Sundays and holidays. Secondly, they are fitted with slides, by opening which coke can be stored over the whole space at the end of the retort house to a depth of 20 feet.

In this installation, therefore, the coke, amounting to 80 tons per day, can be drawn from the retorts, dropped into the conveyor, carried to the outside of the retort house, get thoroughly quenched there, pass into the coke breaker if broken coke is wanted, or pass direct to the cross conveyor, be elevated to the top of the screens, go through the screens where the coke and breeze and dust are separated, be stored in overhead hoppers, and be loaded into carts or railway wagons, without any hand labor at all, except the opening of the doors in the hopper to let the coke fall out into the wagon.

The conveyors in the retort house consist of two troughs—one on each side of the bench—built up of steel plates and angles. The troughs are a little over 2 feet wide, and are let in level with the floor plates. The troughs are continuous from end to end of the house, under the railways outside, and up the sloping ends to the top, the horizontal portion being joined to the slope by a curved piece, of which the radius is considerable and the curve very easy. In this trough a transmitting chain is laid. The chain is formed of two lines of links kept apart by means of round iron stay bars at intervals, so that each line of links runs close to the sides of the trough, where there is placed a line of angle steel to form renewable pieces to take the wear. The chain rather resembles a rope ladder than anything else we can think of at the moment. It is continuous throughout the length of trough up to the top of the slope, where it passes over two pulleys or rollers keyed to a shaft running in bearings. The chain then returns inside the lower member of the latticed structure, and then engages with the two sprocket wheels of the driving mechanism. It next takes a course round a weighted tension roller, and up a sloping angle steel roadway to the underside of the girders supporting the retort house floor. The angle roadway is bolted to these girders, and takes up a space of 4 inches below them, extending from end to end of the retort house. The chain then passes round another pair of rollers, and so back into the trough in the retort house floor. Water is run into the trough at the end of the retort house, from a plain pipe, so that the water follows the coke as it is moved along by the chain. At the commencement of the sloping end, there is fixed another water pipe for the purpose of making good the rapid evaporation which takes place from the quenching of the coke.

As soon as a "draw" is completed, the water is allowed to run into the trough until it is filled to a depth of ¼ or ½ an inch, when both taps are closed. Immediately before the commencement of the next "draw," the driving apparatus is started, and the chain travels very slowly towards the sloping end and returns underneath the floor. The coke is then drawn out of the retorts and falls directly into the trough, the whole width of which is clear, except for about 1½ inches at each side, where the chain runs. Owing to the forward motion of the chain one of the stay bars comes against the heap of coke, and sets it in motion; and it continues to move forward by sliding gently along without showing any tendency to turn over or move at all except bodily. No doubt the small amount of water in the trough serves to lubricate the way, as well as to keep the trough and chain quite cool. The moving heap of coke pushes the water in the whole length of the trough before it, and so fills the portion at the foot of the slope to a considerable depth; and the sides are considerably deeper there to allow for this. As soon as the coke (which is still red hot in the mass, though quite quenched at the bottom for an inch or two) arrives at the foot of the slope, the water is pushed still further up the slope until the action of gravity overcomes the resistance to backward flow through the mass of the coke; and then the water falls back over the top of it, and through its mass, quickly quenching it thoroughly—the rapid and somewhat turbulent evaporation of the water causing the operation to be more complete. While the quenching is going on, the coke is being moved forward up the slope; and as soon as it gets above the surface of the water, the surplus moisture immediately drains out of it, and runs back down the slope, while the heat still left in the coke evaporates a further portion, and makes it practically dry a few feet above the foot of the slope. There is no waste of water out of the trough, except that lost by evaporation in quenching; and none overflows into any other portion of the apparatus.

The operation of the conveyor and the quenching of the coke have been described somewhat minutely, because of the exceedingly simple means employed to attain a thoroughly satisfactory result. There is nothing more complicated than a couple of plug cocks and two pieces of plain pipe used in the whole operation of quenching—no sprays, nor roses, nor any other delicate parts. Indeed, the prominent feature of the whole of the mechanism is its simplicity. For instance, an inspection of the conveyor at rest would lead nine out of every ten competent men to say that such a plant would be more likely to smash the coke than to move it, especially at the inclined end; yet the fact is that the coke is pushed along in a manner which can only be described as practically perfect.

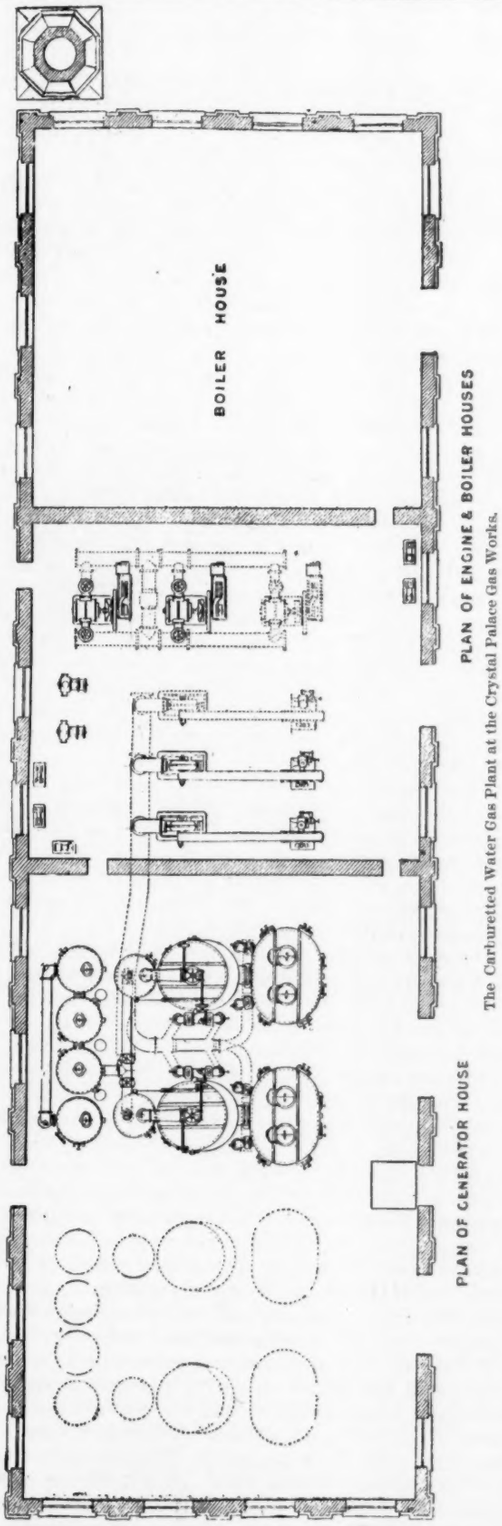
Great credit is due to M. De Brouwer for the three chief features of his patent: First, the idea of placing a remarkably simple and light transmitting apparatus in a trough in such a way as to cause the larger lumps of coke to push the breeze and small pieces forward. Second, the supply of water to the trough to keep the parts cool, and the use of the water at the delivery end of the plant to quench the coke thoroughly, together with the inclined end for draining and drying the coke, to prevent its being saturated and waterlogged. Third, the sloping end continuous with the horizontal portion to act as an elevator, and save all the endless trouble, wear and tear of machinery, and crushing of coke which arises from the dropping of the coke from a conveyor to an elevator. Then the absence of anything but the merest puff of steam inside the retort house must add comfort to the workmen and tend to increase their healthfulness; the enormous volumes of steam generated at the quenching place outside indicate conclusively the relief of the atmosphere of the retort house.

The apparatus at the Crystal Palace works is driven by means of a 14 horse power Tangye gas engine placed in a room under the floor of the retort house, and driving a line of shafting outside the walls of the house under the railway. There are separate friction clutches for starting or stopping any of the three conveyors, and claw clutches for controlling the coal breakers; the levers for working the clutches being all brought to convenient stands above ground.

A fact illustrative of the vast difference between gas works engineering on the Continent and that in England has come to our knowledge during a visit to this plant. Nearly every English engineer who had seen the conveyors at work in Belgium came over with the thought that success on the Continent did not mean certain success here, because the retort houses there are mostly short, and the apparatus is therefore made light. Considerable criticism was spent on the chains forming the transmitting part The ever present subject of wear and tear of the structure also seemed to weigh heavily in the minds of English engineers. The troughs on the Continent are made of two side angle irons riveted to a bottom plate, on which the coke moves. The destruction of this plate in the course of years means to English engineers the practical renewal of the whole plant. It was only after much disappointment in getting the conveyor adopted that Mr. Jenkins hit upon the very simple and consequently efficient plan of making the wearing portion of the troughs easily renewable, and quite distinct from the permanent structure. This is done by placing in the trough a plate forming a false bottom. The difficulty of the strength of the chain was met by making the links proportionately stronger, and all of forged steel instead of castings; all holes being bored and pins turned exactly to gauge.

Mr. Shoubridge and his Directors deserve the thanks of the gas industry for having the courage to adopt the first of these conveyors on this side of the channel; and we trust they will find the machinery as successful in their case as it seems to have been in a large number of places on the Continent. We would also bear testimony to the thought and practical skill which Messrs. Jenkins & Co. have spent on the design and construction of the apparatus.

The Carburetted Water Gas Plant.—We now come to the carburetted water gas plant, which, although it is given second place here, is really of superior importance to the Company in that it forms a powerful addition to their productive capabilities. The principal portion of the plant is housed in a building which, while it does not possess any particularly striking structural features, is interesting from the fact that the whole of the bricks and even the artificial stone copings and finials (composed of fine granite chippings and portland cement) were made on the works by the Company's own men, who also did the constructive work. In passing, it may interest readers to learn that the works are situated on a bed of clay some 60 to 70 feet in depth; and in order to utilize this, to give employment to their men during the slack



The Carburetted Water Gas Plant at the Crystal Palace Gas Works.

season, and to profitably dispose of the spoil from excavations, the Company have put down a complete brick making plant, with the result that last year something like 2 million bricks were produced. Returning to the subject in hand, the disposition of the buildings and water gas plant will be seen on the accompanying plan. The generator room is 93 feet by 58 feet 3 inches by 40 feet, inside measurements. It has an iron and slate roof; and is exceedingly well lighted. Adjoining is the engine room, the dimensions of which are 50 feet by 58 feet by 20 feet; and next to it is the boiler room, which is 56 feet by 58 feet, and the same height as the engine room. These buildings and the machinery have all been designed for four sets of plant, equal to a daily production of 5 million cubic feet of carburetted water gas. At present only half the space is occupied with two sets of plant, capable of producing together 2½ million cubic feet a day.

The plant, which has been constructed under the Merrifield-Westcott-Pearson patents, was supplied and erected by the Economical Gas Apparatus Construction Company, Limited. It has only been at work a few weeks, and during that time not fully; so that there has not been an opportunity of thoroughly testing its performance. But so far as Mr. Shoubridge has been able to judge, the work has been carried out very satisfactorily; and the plant has, in actual work, considerably exceeded its nominal output. This promises well for the satisfactory fulfilment of the contractors' guarantee, which is to the effect that the plant shall give an efficiency equal, if not superior, to that of any yet erected. The generators are oval in shape, built of tank steel, with the usual double firebrick linings, and asbestos non-conducting material between the firebrick and the shells. They have hopper bottoms for removing the ashes, also stoking holes for removing the clinkers from the grate bars, and two coaling holes on each generator for the equal distribution of the fuel. The superheaters and fixing chambers are in one shell; the superheaters being oval, and the section of the fixing chamber circular—the total height being 38 feet. These also have the usual substantial firebrick lining and asbestos non-conducting material between the firebrick and the shell. They are divided into two compartments by firebrick arches, supported from the foundations, so that no strain can come upon the shells; the superheaters and fixing chambers being filled with checker bricks. Each compartment is provided with an air blast connection, which enables the operators to control the heats and keep them at the proper temperature in each chamber. The carburetting chamber is an open space between the other two.

The generators and superheaters are connected together with water cooled valves and short connections. The valves are so arranged and connected up with hand wheels, racks and pinions that, by opening one, it closes the other; at the same time reversing the steam to the generator—gas then being made up or down in the generator according to the position of the water cooled valves. The water gas leaves the generator either at the bottom or top, passing to a flue in the superheater common to both openings. It then travels down the flue to the bottom of the superheater, and up through a mass of hot checker brick, where it is superheated to about 1,500° or 1,600° F. At the base of the fixing chamber, or just below it, the water gas comes into contact with a finely divided stream of oil sprayed into the chamber by an improved oil injector, arranged at equal distances around the shell. The injector sprays the oil, in the form of a batswing gas flame, in a thin wide sheet, and the hot water gas vaporizes it and mixes with the oil vapors, carrying them through the beehive arch and the hot checker bricks of the fixing chamber, where the oil is fixed and converted into permanent gas. It then passes off through the gas outlet and take-off pipe to the washer; thence through the oil heater to the scrubbers, condensers and relief holder. There are two scrubbers and two condensers so arranged that the gas passes through both scrubbers and both condensers. The oil is heated before entering the vaporizing chamber by the hot gas on its way from the washers to the scrubbers; the oil heater being placed between the wash box and the scrubbers, and the gas giving up part of its heat to the oil. It is claimed that, by this mode of heating the oil, better results and a more uniform temperature are obtained, as the oil heater coils do not become clogged up with lampblack and pitch—thus saving considerable time and annoyance in cleaning.

Reverting to the generator, another advantage claimed is that, with a greater area of grate bar and a shallow fire bed, an increased make of gas from a given amount of fuel is obtained; or, in other words, less fuel per 1,000 cubic feet of gas produced is required. This is accomplished by blowing the generators so as to produce just sufficient carbonic oxide to keep the superheater and fixing chamber at the proper temperature to fix the oil and burn the excess carbonic oxide to carbonic acid in the generator, and storing the heat in the fuel to decompose the steam, allowing no carbonic oxide to escape to smokestack.

There are several other improvements on the plant, such as the valves in the wash boxes, which are so connected up that, when the stack valve is open, the valve in the wash box is closed over the end of the dip pipe, preventing any escape of gas to the fixing chamber. When the stack valve is open from loss of seal in the washers, or other causes familiar to gas makers, with this arrangement the water can be entirely drawn out of the wash boxes, and the valve opened without any danger of an explosion, which is liable to take place by the gas igniting in the take off pipe.

Coming next to the engine room (the dimensions of which have already been stated), we think we may say, without fear of contradiction, that it is one of the brightest engine rooms in connection with water gas plant in the kingdom. The walls are built of glazed bricks, with ornamental dado and frieze. The floor is tiled, and the roof is

lined with stained boards. The room is well lighted with side windows, and near its apex a portion of the roof is also glazed. The machinery comprises two Sturtevant gas blowers, strap driven by two Tangye engines, of the high speed inverted type (350 revolutions), made specially for this class of work. There are also two of Messrs. Waller & Company's 4-blade exhausters and engines, each capable of dealing with 100,000 cubic feet of gas an hour, and used for pumping the gas out of the relief holder and forcing it through the purifiers and meter into the storage holder. A number of other pumps for oil and water complete the equipment of the room. The machinery is all in duplicate—one set being sufficient for working the water gas plant so far erected; the other set being kept in reserve.

In the adjoining boiler house, there are two boilers, 30 feet long by 8 feet diameter, fired with breeze and tar made in the water gas plant. They are fitted with a forced draught arrangement; but this is hardly a necessity when firing with tar, because the house is provided with a good chimney, 120 feet in height. Under the conditions prevailing here, that very difficult operation of burning tar without smoke is accomplished. By means of two small valves, the steam and tar sprays are under complete control.

A unique and most important feature in promoting the efficiency of this water gas plant is the method of re-circulating the water, and dealing with the tar. All the effluent liquor from the apparatus is run off into a specially designed tar separator (placed underground), where the tar automatically works its way into one compartment, from which it runs out of its own accord into a tar settling tank. From here it is pumped to the feed tank in the boiler room for use as fuel, or, preferably, taken to the tar well for sale. The effluent water from the separator runs into the water tank, from whence it is pumped and re circulated over and over again through the washers and scrubbers—thus in a short time becoming saturated with the different components of the gas. The condenser water is re-circulated and made use of; so that the only water which has to be provided after the plant has once been started is that required for the boilers.

Within a convenient distance of the generator house is the oil storage tank, 60 feet diameter by 25 feet deep, and capable of holding 442,000 gallons. The oil is sent to the works in tank wagons, and pumped from them into the storage tank, from which it is pumped to the carburetting chambers as may be needed from time to time.

The gas passes from the condensers and scrubbers to an existing holder, which is used as a relief holder, and from there it is exhausted and forced through a set of new purifiers. The house in which these are located is a skeleton structure, made of steel stanchions and girders, built in three stages—the purifiers being on the second stage, with a revivifying floor above. The latter is constructed of breeze concrete, strengthened by pieces of old gas tubing, somewhat on the principle of the Monnier system. The contractors for the ironwork and purifiers were Messrs. C. & W. Walker, of Donnington. The purifiers, five in number, are each 40 feet by 22 feet by 4 feet 9 inches without lutes; each vessel having two lids, with india rubber joints, similar to the plan adopted by Mr. Henry Green, at Preston. Two light travelling cranes have been provided for lifting the lids. In emptying the purifiers, the material in the case of oxide fall through openings in the bottom of the boxes, into trucks on rails beneath, which convey it to a hoist at one side of the structure, which raises it to the revivifying floor above.

When revivified, the material is returned to the purifiers from the upper floor by means of shoots. Three of the purifiers are charged with lime and two with oxide. The connections throughout are 24 inch; and the purifiers are all controlled by means of Weck center valves. Close to the purifier house is the meter for the carburetted water gas. It is built on Mr. Livesey's brick tank principle, was supplied by the Gas Meter Company, and has a capacity of 100,000 cubic feet per hour. Adjacent to this, a photometer house is being erected.

Projected Inclined Retort Installations.—This ends our notice of the completed extensions and improvements, and now just a few words in conclusion as to the next steps to be taken in the remodelling of the works.

At the present time, one of the old retort houses, the settings in which were quite worn out, has been razed to the ground, and a new building is to be erected and furnished with inclined retort plant similar to that Mr. Shoubridge put in at Salford. It is hoped the house will be finished in time to assist in meeting the demands of next winter. Eventually, if Mr. Shoubridge's intentions are consummated, the whole of the horizontal retort settings on the works now worked by hand will, as they reach the end of their profitable working life, be converted to the inclined retort system. Sufficient has been said to show that the Crystal Palace Gas Works will, in the near future, contain one of the best equipments on modern lines of any similar establishment near London.

[Concluded from Page 210.]

The Recovery of Nitrogen in Coal Distillation.[1]

[By W. Carrick Anderson, D.Sc., and James Roberts, F.C.S.]

Liming of Coal.—In 1883 attention was called by Mr. J. Alfred Wanklyn to a process patented by Mr. W. J. Cooper, for increasing the yields of tar and ammonia in the distillation of coal by "liming" the coal. "Limed coal is made by taking quicklime, slaking it, and thereby getting it into a state of fine division, and mixing the finely divided slaked lime with the coal." The proportions recommended were slaked lime equivalent to 2½ parts quicklime to 100 parts of coal. Regarding the utility of the liming process, the evidence of gas engineers was of the most contradictory character. At Beckton gas works the increase in ammonia recovery was reported to be 36 per cent., at the Commercial gas works 27 to 28 per cent., at Cheltenham 20 per cent. Mr. Cooper himself stated that experiment had proved the gain in ammonia to vary from 20 to 100 per cent. On the other hand, the Bankside works of the South Metropolitan Company reported no gain of ammonia while using the process, and this result was confirmed at the Vauxhall works of the same Company, where no improvement was noted although 30,000 tons of coal were treated by the process.

Now, in the face of positive statements by well known engineers, that in the works under their control an increased quantity of ammonia was recovered while the process was in operation, it would be idle to deny that, in the case of certain coals at least, an admixture of slaked lime produces an effect in the distillation. But our experiments detailed above show that, in the case of these typical Scotch coals at least, the nitrogen which, under ordinary conditions of distillation, remains fixed in the coke, is not liberated in any form by distillation with lime, even when the latter is employed in a much greater proportion than could be suggested for use in any commercial process. The augmentation of ammonia, when it occurs, is therefore apparently to be ascribed to an effect produced on that part which is set free, even under ordinary conditions of distillation, and which may ultimately appear either in the form of ammonia or of free nitrogen. In this case the action of the lime would consist in altering the rate of conductivity of the charge, and also, it may be, in setting free the elements of water above a certain limit of temperature, which, diffused through the gases, might aid in maintaining the stability of the alkali.

Apart altogether from the results of our experiments, it is impossible to conceive that the lime, mixed as it was in the original process with the coal, by hand or mechanical means, could exercise any great influence on the fixed nitrogen of the coal. Unless the two were ground together to the state of an impalpable powder, the non-volatile and infusible earth must necessarily have failed to reach anything more than a fraction of the nitrogenous molecules present in the charge.

A like objection applies to every attempt (and how numerous have been the suggestions!) to remove this residual nitrogen from coke by steaming, or application of external reagents, after the coke is made. Metallurgical coke, as Thörner's microscopical researches have shown, is a mass of cells, the walls of which are thoroughly vitrified and gas-tight. Steam, except in so far as it burns away the carbon of the coke, scarcely comes in contact with the nitrogenous constituents of the latter, protected as they are by this impervious coating.

Nitrogen Set Free from Coal.—From the experiments described above it appears that when small quantities of coal are distilled, a fairly constant percentage of the total nitrogen remains behind in the fixed residue, averaging about 64 per cent. The balance of about 36 per cent. is set free in three forms, alkaloidal and other nitrogeneous bodies in the tar, ammonia in the liquor, and free nitrogen in the gas.

The quantity of nitrogen in the tar is affected greatly by the temperature of distillation. Watson Smith gives 1.667 per cent. as the quantity found in a sample of (high temperature?) tar. A sample of Scotch splint distilled at a fairly low temperature, we found to yield a tar containing 1.11 per cent. of nitrogen. If we take the yield of tar as being about 10 per cent. of the weight of the coal, and regard it as containing, on an average, 1.4 per cent. of nitrogen, this would represent 0.14 per cent. nitrogen calculated on the weight of the coal itself. Assuming again that this latter contains 1.4 per cent. nitrogen altogether, the amount found in the tar is equal to 10 per cent. of the total.

Watson Smith's calculation of Foster's results shows 48.68 per cent. of the nitrogen in the coke; Knublauch gives the average figure for Weslphalian coal as 50 per cent. in the coke; and these we regard as nearer the average figure under practical working conditions than the

1. From a paper read before the Scottish Section of the British Section of Mechanical Industry.

61 per cent. which we found in cokes got by rapidly igniting small quantities of coal in a platinum crucible.

These two items then, taken together, account for 60, or at the most, 65 per cent. of the total nitrogen. The balance of 35 to 40 per cent. comes off as ammonia and free nitrogen in the gases. Regarding the quantity ordinarily making its appearance as ammonia, there is a remarkable unanimity in the evidence from all sources. The average yield of sulphate per ton of coal distilled in this country we have stated to be about 22 pounds, equivalent to 4.67 pounds of nitrogen, or, in other words, 0.21 per cent. of the coal is represented by nitrogen which is evolved and collected as ammonia. If we regard 1.4 per cent. as the average nitrogen content of the coal distilled, this result would be equivalent to 15 per cent. of the total nitrogen present. Carefully conducted distillations of specimens of Scotch and English splints gave us in the laboratory 19.6 per cent. and 18 per cent., respectively. For Westphalian coals, Knublauch quotes 12 to 14 per cent., and Foster's results for English coals show 14.5 per cent.; E. Schilling gives 15.1 per cent., while Tichauer states that the figure varies from 13 to 24 per cent.

Fifteen per cent. may therefore fairly be regarded as a close approximation to the actual practical yield of ammoniacal nitrogen. The balance unaccounted for is about 25 per cent., and with the exception of a very small quantity which appears as cyanogen compounds, this large proportion exists as free nitrogen in the gaseous products of distillation. It is present in estimable quantity in all coal gas, and L. T. Wright has shown that Newcastle gas contains 2.8 to 3.4 per cent. of nitrogen, when every precaution has been taken to exclude air.

To account for the presence of this free nitrogen among the gaseous products of distillation, it is necessary to recall the fact to which we have already alluded, that the decomposition of the nitrogenous part of coal with formation of ammonia begins in the different specimens only when they are heated to over 375° C., and in many cases not till a very much higher temperature is reached. But it has been shown by Ramsay and Young that under favorable conditions ammonia begins to dissociate at a temperature slightly under 500° C., and that the decomposition is complete at 780° C. Since, therefore, under the ordinary conditions of destructive distillation, the temperature of the charge is continually rising, it is inevitable that a considerable part of the decomposition of the coal must take place at a temperature sufficiently high to admit of more or less of the resulting ammonia being dissociated in contact with heated surfaces. No doubt this decomposition will be retarded to some extent by the presence of a protecting atmosphere of hydrogen and hydrogen-containing gases, but at higher temperatures it will not be altogether prevented. On the other hand, carefully conducted experiments have shown us that so long as the distillation is carried on at temperatures below 500° C., no part of the nitrogen contained in the coal makes its appearance in the free state. For example, when 3 grammes of Scotch splint coal were distilled for three hours at a temperature varying from 440° to 470° C., the nitrogen of the coal (1.50 per cent.) distributed itself in the manner shown in Table VI.

Table VI.

	Nitrogen Grm.	Percentage.
In the coke (=1.93 grms.)	0.03540	78.67
In the aqueous distillate as ammonia	0.00476	10.58
In the tar (=0.41 grm. containing 1.11 per cent.)	0.00455	10.11
Total nitrogen found	0.04471	99.36
Total nitrogen in coal used	0.04500	100.00
Balance unaccounted for	0.00029	0.64

If a small sample of coal which has been ignited for five minutes over the blowpipe in a closed vessel, so as to expel its volatile matter, be tested for nitrogen it will be found that, even although kept at a bright red heat for five or six hours, no further portion of the nitrogen remaining is expelled, thus:

Table VII.

	Sample "A." Per Cent.	Sample "B." Per Cent.
Nitrogen in coke (5 min.)	2.19	2.10
Nitrogen in coke after 6½ hours at red heat	2.14	2.18

On the other hand, when a quantity of coke from sample "B," which had already been heated for 5½ hours, was subsequently heated to redness in a stream of hydrogen gas for six hours, it parted with 17.27 per cent. of its nitrogen in the form of ammonia.

Table VIII.

	Grm.	Grm.
Nitrogen in 0.7 gramme of coke from sample "B"		0.01526
Nitrogen collected as ammonia on passing hydrogen over this for six hours at red heat	0.00266	
Nitrogen found in the residue	0.01274	
		0.01540
Experimental error		0.00014
		=0.9 per cent.

From the results of these experiments it seems exceedingly improbable that any part of the nitrogen of coal is liberated in the distillation process as free nitrogen, and its invariable presence in the gaseous product may therefore be set down to a more or less extensive dissociation of the previously formed ammonia in contact with heated surfaces. It was pointed out by Ramsay and Young that the rate of such dissociation was influenced both by the extent and the character of the heated surface, as well as by the time of exposure to its action. In general, a rough surface may be said to facilitate the decomposition. There can be little doubt that these causes operate to some extent in gas retorts, and very powerfully in coke ovens. In the latter, the ammoniacal gases being evolved from the central portions of the charge have to make their way to the exit tube through a layer of partially coked material, which is already at a fairly high temperature. The conditions, so far as the roughness of the solid surface and the rate of passage of the gas are concerned, are almost ideal for bringing about dissociation to the utmost extent, and go a long way to explain the fact that, while for the whole country the average yield of sulphate from gas works is 22.4 lbs. per ton, that from coke ovens is only 19.7 lbs.

Ammonia in the Blast Furnace.—The recovery of ammonia from the gases of the blast furnace presents itself as a special case of what is carried on in the gas works. Apart from the engineering difficulty of dealing with the 130,000 cubic feet, or thereby, of gas per ton, as against some 10,000 in the gas works, the process would present no extra difficulty, were it not for one factor which has hitherto been most remarkably ignored. So far as avoiding the danger arising from simple dissociation of the alkali is concerned, the gradual descent of the charge in the furnace admits of distillation being carried on for a fairly lengthy period at a low temperature, as compared with that obtaining in the gas retort, while, since the gas, in rising, is continually passing into zones of diminishing temperatures, the alkali does not here incur the risk of dissociation to the same extent as in making its escape from the coke oven. Yet we find that the average yield from blast furnaces is only 20.2 lbs., as against 22.4 gas works. What is the reason?

A long-continued series of experimental trials established conclusively that the presence of iron ore in the distillation charge was responsible for a very serious falling off in the yield of sulphate of ammonia, and that this was brought about by oxidation of the ammonia by the oxide of iron, a reaction which begins at a fairly low temperature. A sample of splint which gave, when distilled, about 31.65 lbs. of sulphate of ammonia, yielded, when treated as nearly as possible under the same conditions of temperature, but in the presence of calcined clayband ore in the proportions of an ordinary blast furnace charge, only 23 lbs. of sulphate. Another coal, similarly treated, gave—

When distilled alone	30.73 lbs.	am.	sulph.	per ton.
When distilled with ore "A"	17.11	"	"	"
When distilled with ore "B"	17 97	"	"	"

In order to determine the rate at which this destruction of ammonia proceeded at different temperatures, an independent investigation was set on foot, which showed that the action begins at a fairly low heat, and rapidly increases as the temperature rises.

From these experiments it is obvious that the presence of the ore in the upper part of the blast furnace cannot be regarded as a negligible quantity in weighing the different factors that contribute to the result. Too much stress may, of course, be placed upon the figures representing the destruction of ammonia in passing it alone over heated iron ore. The conditions in such an experiment are not identical with those obtaining in a blast furnace, where the alkali is protected by an atmosphere of hydrogen and hydrogen compounds. Still, the distillation experiments, described above, which were done under conditions somewhat resembling those obtaining in practice, show that a serious falling off in the yield of sulphate of ammonia may result from the operation of this cause.

Summary.—We may now gather up the conclusions which we are inclined to regard as the result of these experiments:

(1.) When coal is heated, part of the nitrogen contained in the nitrogenous constituent comes off as ammonia in the gases, part goes to form

nitrogenous compounds in the tar, the rest remains fixed in the solid residue or coke.

(2.) The percentage which is thus evolved as ammonia is dependent partly on the structure of the nitrogenous constituent of the coal, as well as on two other factors, the amount of hydrogen available to combine with and carry off the nitrogen, and the period during which the nitrogenous body is exposed to the influence of the hydrogen above a certain limit of temperature.

(3.) Heating the nitrogen-containing body had no effect alone in dislodging the nitrogen; there must be a simultaneous action of hydrogen or certain hydrogenized compounds.

(4.) The presence of free nitrogen in the gases got from distillation of coal, amounting frequently to 25 per cent. of the total nitrogen of the coal, is due to dissociation of the ammonia at temperatures over 500° C.

(5.) The amount of this dissociation is increased by rise in temperature and by increase in the time during which the gas is exposed to the heat. For this reason, although in a coke oven the charge is subjected to a more gradual heating than in a gas retort, the quantity of ammonia recovered may be actually much less than in the latter case, because, in the coke oven, the ammonia liberated in the lower part of the charge is subjected to dissociation conditions for a longer time in passing upwards through a thick crust of strongly heated coke.

(6.) In blast furnaces the oxide of iron exercises a destructive effect on the ammonia at comparatively low temperatures, and while, owing to the very gradual descent of the raw coal towards the hotter region of the furnace, a considerable part of the ammonia will be formed, and escape before the limit of dissociation is attained, yet the influence of the oxide of iron in the ore, which is active at very much lower temperatures, may be such as to more than counterbalance the benefit derived from these favorable conditions, and bring out the average yield of sulphate at a lower figure.

Discussion.

Mr. W. Foulis (Glasgow) said that 20 years ago Professor Foster made the experiments referred to by Dr. Anderson, and the results obtained agreed more than approximately. Professor Foster showed that of about 1.7 per cent. of nitrogen in coal only about 0.25 per cent was recovered in the form of ammonia, and of the balance about 50 per cent. was left in the coke. Another point proved by his experiments, which also agreed with the statement made in the paper, was that the bulk of the ammonia was evolved during the earlier part of the period of carbonization, very little being evolved at the later stage, when the temperature in the retort was higher, and when, no doubt, decomposition of the ammonia took place, and had been suggested. Subsequent experiments had also shown that cyanogen compounds were liberated in the latter period of the charge, whilst there was very little of the cyanogen compounds earlier in the period. Since those experiments were published, a great many attempts had been made to recover the nitrogen which was thus lost. On the experiment of liming the coal in the retort, which had been referred to, a great deal of time and money was spent, but it was an utter failure; and he could not help thinking there must have been some error made in those experiments that showed such a large percentage of increase of ammonia, because the coals used in all the works where the process was tried were very similar in quality, and the difference in the results obtained could not arise from this cause. Since that time experiments had been tried for the purpose of recovering the nitrogen which was left in the coke, by passing steam through the red hot coke after the gas was eliminated, and he believed with some degree of success, but whatever the success was experimentally, it had not proved commercially successful, and he did not know of any such process now being carried on. He thought the quantity of ammonia given off in the retort depended a good deal on the state of the coal. He was of opinion that wet coal yielded a larger quantity of ammonia than dry coal, but he had no definite data to go upon. The recovery of nitrogen eliminated in the form of cyanogen had occupied his attention to a considerable extent for several years. It was exceedingly doubtful in what form it existed in the gas. Professor Foster proved that when the gas was passed through the lime purifiers, if the lime was in a damp state, the cyanogen was converted into ammonia, and this was a fact which was well known from experience in daily practice. Several years ago he commenced a number of experiments which in the end proved successful, and they now recovered cyanogen in the form of ferrocyanide of soda, by simply passing the gas, after the ammonia had been eliminated from it, through scrubbers in which an iron salt was maintained in suspension in an alkaline solution of soda or potash, and in that way they got cyanogen in the form of ferrocyanide of soda or potash, and free from sulphur. An amount of cyanogen equivalent to from 3½ to 4 pounds of crystallized ferrocyanide of soda per ton of coal carbonized was thus recovered.

Mr. Beilby said that in his experience the differences in the physical structure of the various kinds of coal had an important influence on the distribution of the nitrogen during and after distillation. Splint, cannel and coking coal in their natural state showed obvious differences of structure. After the coals were coked these differences were accentuated. Splint and cannel not only retained the outward form of the original coal, but also, to a considerable extent, its organized structure. Therefore their porosity was akin to that of charred wood and other vegetable remains. In second class cannels, as well as in oil shales, the mineral matter added considerably to the porosity of the residual coke. It seemed probable that the extent of red hot surface, over which the more complex nitrogenous products of the coals had to pass during distillation, would largely determine the proportions in which free nitrogen, ammonia and nitrogenous bases would appear among the products of distillation. Any one who had attempted to decompose these basic substances so as to obtain their nitrogen as ammonia, must have recognized the all-powerful influence of surface on the decomposition. In order to completely resolve the basic tars from peat into ammonia, Grouven found it necessary to pass the vapors over a specially prepared porous material, to which he gave the name of "Contact Masse." No doubt, as Dr. Anderson pointed out, the primary nitrogenous substances of the different kinds of coal might be more or less easily decomposed; but it seemed perfectly clear that the conditions which influenced the decomposition were to a considerable extent to be found in the physical structure of the coal itself.

Mr. H. Bumby said that Dr. Anderson's paper had cleared up several points which had puzzled him and others who were working at the subject on a large scale. He thought that Dr. Anderson's statement of the yield of ammonium sulphate from the blast furnace—viz., 20 pounds per ton of coal—was probably approximately correct for the whole country; but in the district specially under consideration (Lanarkshire) he believed the average yield would be about 23 pounds, and he knew of cases in which it was considerably larger. He mentioned several sources of loss of nitrogen, and referred, first, to the gas which escaped on lowering the furnace bell. He had recently spent some time trying to determine that loss, and had found it to vary from 2½ to 5 per cent. of the total gas, and thought it probably generally approached 5 per cent. There was also a small loss from combustion round the bell, and on account of the pressure maintained at this point to avoid risk of explosion. Second, it was the general practice to clean out the flue dust through small holes in the gas tubing whilst the furnaces were working, and some loss of gas was occasioned in that operation. He thought that all these together would cause a loss of from 8 to 10 per cent. of gas and a corresponding loss of ammonia. There was also a very small loss of ammonia which escaped condensation, and of combined ammonia lost in the lees water, though these together should not exceed 0 5 to 0.6 per cent. of the total. Adding these losses to the amount actually recovered gave a total of ammonia, present in the gases as they left the top of the blast furnaces, somewhat exceeding what might be expected from Dr. Anderson's experiments, and he asked whether the authors had fully considered the influence of the steam and hydrogen present in the blast furnace on the evolution of ammonia. With regard to the effect of iron ore, he asked whether the experiments were conducted with dry material or in an atmosphere of steam and hydrogen such as existed in the blast furnace. The bulk of the ores used at the present time consisted of hydrated ferric oxide, often in large lumps, and they carried down a portion at least of their combined water to a part of the furnace below that at which the bulk of the ammonia was evolved. The splint ore also contained a considerable percentage of water, which probably helped to form a protective atmosphere for the ammonia. The total amount of water condensed from the gases often amounted to 30 per cent. of the weight of coal used, and the gases contained from 7 to 8.3 per cent. by volume of hydrogen. The change in the nitrogen compounds in coal on exposure to air explained the loss of ammonia which was always experienced on using "bing" coal which had been lying exposed to the atmosphere for a long time. Referring to Mr. Foulis's remarks regarding the formation of cyanogen, Mr. Bumby stated that a similar observation was made in the blast furnace. Cyanogen was evolved at the tuyeres, and fumes of alkaline cyanides were frequently found at the tuyere arches. Higher up in furnace the cyanogen was decomposed and helped to reduce and carburize the iron. A small sublimate of alkaline cyanides was, however, sometimes found at the top of the gas tubes in coke furnaces, though he had so far been unable to detect it in coal-fed furnaces.

Mr. Lean said that he had been recently engaged, in conjunction with Dr. Anderson, in investigating the destruction of ammonia in contact with iron ores, and hoped to be able to communicate the results of the experiments to the Society at an early date. The destruction of the ammonia, under the conditions of their experiments, was very marked above 260° C.; at 280° C. it amounted to at least 75 per cent. of the ammonia passed over the ore, and at temperatures above 300° complete decomposition of the ammonia seemed to have been effected.

Mr. Robert Hamilton said that he found it difficult to reconcile the results of Dr. Anderson's experiments with those obtained by Mr. Bumby on a large scale. Dr. Anderson had stated that a coal which gave about 31 pounds of sulphate on distillation in the laboratory only yielded 22 pounds when distilled in presence of iron ore, a result which showed a very considerable loss, while Mr. Bumby had pointed out that some furnaces were giving over 25 pounds, notwithstanding the considerable loss of gas to which he had referred in the course of his remarks. He (Mr. Hamilton) had carried out some experiments on the distillation of coal with iron ore in a manner similar to that described by Dr. Anderson. He directed his attention more especially to the preservation of the tar, and found the difference between the results of his experiments and those obtained in practice to be even more striking than that mentioned above. When the coal was distilled with iron ore in the proportions in which it was charged into the blast furnace, in some cases only a quarter, and in others a third, or at most a half, of the tar was recovered. These results, which were obtained with English ore and English coal, as well as with Scotch splint coal and Spanish ore, were altogether different from those got on a large scale. He thought that the preservation of the products from the blast furnaces depended on a factor which had hardly been alluded to. Dr. Anderson had referred to the protecting nature of the gas, consisting largely of hydrogen and water vapor, but no reference had been made to the rapid flow of gas, from the top of the furnace. In one case he had made a calculation of the rate of flow of the gas, and had found it to be approximately 80 lineal feet per minute. He thought that the removal of the products of distillation due to this rapid motion of the gases at the top of the furnace explained the fact that the recoveries in practice were much better than laboratory experiments would lead one to suppose.

Dr. Anderson, in reply to Mr. Beilby, said that in the samples they had used the variation in ash would scarcely affect the result, since they were all selected clean nuts in which the ash was always under 2¼ per cent., and were all chosen to allow of them working on pure material. Mr. Beilby had referred to the influence exerted on the distribution of the nitrogen by the form and structure of the coked residue. The view he had expressed, that it materially affected the final result, was no doubt correct, and they had already indicated that such was the case, in the part of their paper dealing with the conclusions arrived at by Ramsay and Young regarding the dissociation of ammonia. Regarding Mr. Bumby's remarks relative to the amount of nitrogen recovered as ammonia in Lanarkshire compared with the country generally, he said that they had referred to that point in an early part of their paper. Lanarkshire splint was one of the coals which gave off its ammonia at the lowest temperature, and under those conditions a large percentage of the ammonia evolved had a chance of escaping from the top of the furnace before the action of the ore came vigorously into play. On the other hand, there were coals from which the evolution of ammonia began at a considerably higher temperature, and in such cases the risk of destruction of the alkali of the raw ore was much increased, and the amount of ammonia dissociated would also be greater. The statement that the average quantity of ammonia recovered in Lanarkshire was larger than that which they had quoted for the whole country was certainly correct; but, on the other hand, the average percentage of nitrogen contained in Lanarkshire coals, so far as they had examined them, was higher than the average of 1.4 per cent. which they had adopted for the bituminous coals over the whole country. Regarding the experiments of distilling coal mixed with raw iron ores, they did not profess to have imitated exactly the conditions obtaining in the upper part of a blast furnace. The experiments had been conducted both with hydrated and with calcined ores, and the destruction of ammonia appeared to be greater in the latter than in the former case, so that the water which was evolved in the case of the former seemed to have the effect of protecting the ammonia to some extent. The rapidity with which the gases escaped from the furnace had been mentioned as probably exercising some influence on the result, and Dr. Anderson pointed out that the authors had stated in their summary that time was a factor in all the actions by which ammonia was formed and destroyed.

The Semet-Solvay Coke Plant at Dunbar, Pa.

Written for *Mines and Minerals*, by WM. L. AFFELDER, B.S.

After one has passed through the far-famed Connellsville coke region, ever seeing on all sides hundreds upon hundreds of beehive ovens, each one vieing with its neighbors to contribute the greatest amount of smoke and dirt to the already surcharged atmosphere, it is indeed a great relief for him to arrive at the Semet Solvay plant, at Dunbar, Pa. It is at first a little difficult for him to realize that the two rectangular blocks of smokeless masonry are coke ovens, and that they, too, are producing a product similar in practically all respects to that obtained from the smoking, flaming ovens which extend mile after mile along the commercial highways of Fayette and Westmoreland counties. In this region, from which almost 200,000 tons of coke are being shipped each week, there are only 50 by-product ovens, while 19,000 others are each day wasting far more than that many dollars in the wanton destruction of nature's valuable gifts.

In 1895 the Semet-Solvay Company built a plant of 50 ovens at Dunbar, adjoining the plant of the Dunbar Furnace Company. It was the first one erected in this country, excepting a small plant built two years prior to that date at Syracuse, N. Y., by the Solvay Process Company. The former plant has been operated since its completion by the Semet Solvay Company, which Company receives the by-products, while the Dunbar Furnace Company furnishes the Connellsville coking coal required, from it mines at the works, and receives all the coke produced. From the start the plant has been a decided success, and the fact that all of the coke made is used in two large blast furnaces by a company which had previously used beehive coke exclusively, is a sufficient testimonial for the quality of the coke made.

The ovens are built in two symmetrical batteries of 25 each, between which are 4 Heine tubular boilers. The ovens are 32 feet long, 6 feet high, and 16 inches wide at the front end, and 17 inches wide at the rear. The ovens are so built as to be entirely independent of each other as far as their interior construction is concerned. The side walls of each oven are lined with three horizontal flues of D shaped fireclay tile, 20 inches high, 10 inches wide, and 30 inches long. The tiles fit accurately into their neighbors, both at the top and bottom, and at the two ends. The top and middle flue communicate at the rear end of the oven, and the middle and lower one at the front end. At the rear end, the bottom flues of the two side walls open into a hearth flue which extends along the entire oven bottom to the front, where it communicates with a large arched flue extending along the front of the battery beneath the yard. The space between the adjacent flues of two adjoining ovens is built up with firebrick. The top of the oven, with the exception of four circular openings for the admission of coal and the exit of by-product, consists of an arch of firebrick on the inside, surmounted by sand, firebrick, and several courses of red brick. The ends of the ovens consist of red brick, excepting near the doors, where refractory brick are used. The foundation consists of four large arches of masonry extending from end to end of each battery. These arches, which also act as air flues, communicate with each other at intervals, and the two outer flues communicate with one longitudinal flue lying directly beneath the hearth flue of each oven. The outside air has immediate access to the two inner arches only. At the front end of the oven there are two doors, the outer one being sheet iron and the inner one cast iron. Double doors are used to prevent excessive radiation of heat. The outer door is swung on hinges, while the inner one is raised and lowered by means of a jack. The rear end has but one heavy cast iron door, which is moved by a hydraulic cylinder located between the two batteries.

The coke having been removed from an oven, and the doors at the ends having been closed, 4½ tons of run of-mine coal are charged from larries into the three circular charging holes in the top of the red hot oven. The coal is leveled and the lids are placed upon the holes. The doors and lids are carefully luted with loam. A hand hole in the by-product conduit is left open for a short time until the coking has started. Meanwhile gas, which has already been recovered as a by-product, is admitted both at the front end of the upper horizontal side wall flue, and at the rear end of the middle flue through 2 inch gas pipes terminating in tuyères. At both of these points air is admitted in sufficient abundance to burn the gas. The air has been preheated to a temperature of several hundred degrees, by passing through the four arches in the masonry of the foundation and through the longitudinal air flue beneath the hearth combustion flue. From this air flue, the air is conducted to the points of admission of gas through a small vertical flue at each end of the oven. The burning gases pass from the front to the rear end of the uppermost horizontal combustion flue, de-

scend into the middle flue and pass in it to the front of the oven, descend into the lowest flue, and at the rear of the oven pass into the hearth flue. After having once more traversed the entire length of the oven, the still hot gases pass into the chimney flue in front of the battery, and after heating the boilers between the two batteries, escape into the atmosphere through a high chimney. This chimney furnishes all the draft necessary to cause the air to be admitted freely into the combustion flues.

The combustion of the gases in the flues heats the sides and bottom of the oven to a bright red heat, sufficiently high to coke the coal rapidly and completely. On account of the thinness of the inner wall of the flues, only about 2 inches, but little heat is lost in passing from the combustion flues to the coking chamber. Towards the end of the coking process, when the coke gives out rather than requires heat, a considerable amount of heat becomes stored in the partition walls of the ovens, which act as regenerators. When a fresh charge of coal is placed into an oven, the coking chamber draws upon the stored supply. At the end of 24 hours the charge is completely coked, the coke yield being from 72 per cent. to 74 per cent. The doors at both ends of the oven are then opened and the coke is ejected by means of a steam ram, one being used for each battery. The steam for the rams is supplied from the central boiler plant through a pivoted pipe which rotates about a point midway between the two limits of travel of the ram. The fact that the rear end of the oven is 1 inch wider than the front end, greatly facilitates the discharge of the coke. Unlike the ordinary coke plant, this one contains no yard for the storage and shipment of coke. The coke falls from the rear end of the oven into an iron car large enough to hold the coke discharged from one oven. As the coke is falling into the car, it is slowly drawn along the track, at the rear end of the battery, by means of a small haulage engine, the tail rope system being employed. Simultaneously the coke is watered, the surplus water draining from the sloping bottom of the car into a brick gutter at the side of the track. The coke having been sufficiently watered, the car is drawn along the track to the blast furnaces.

Meanwhile the volatile portion of the coal passes through a conical cast iron pipe, from the by-product opening at the top of the oven, into the top of the hydraulic main situated directly above the front end of the battery. The main consists of a covered, sheet iron trough sloping from each end of the battery towards the center. A vertical, iron baffle plate, extending from the top almost to the curved bottom, divides the main longitudinally. Slowly moving water covers the bottom to a height just above the lower edge of the plate. The by-products enter the rear half of the main, and by means of exhausters in the by product house the gas is drawn through the water into the front half, and the heavier by-products are engaged by the water. A 16-inch spirally-riveted pipe carries the by products of each battery to the recovery plant. The gas is carried through the upper portion of this pipe, while the water carrying most of the tar and a considerable portion of the ammonia flows along the lower portion. On reaching the coolers, four of which are used for each of the two batteries, the gas passes into the first cooler while the liquid passes into a settling tank and then into a storage cistern. The coolers are sheet iron cylinders about 8 feet in diameter and 30 feet high. They contain tubes carrying water which flows in a direction opposite to that of the gas, the hottest gas coming in contact with the hottest water.

The cooled gas passes from the fourth cooler into the by-product house, where it is drawn by means of an exhauster through a cast iron spray washer, or scrubber, 8 feet square and 12 feet high, in which it is cleansed of the tar and ammonia which have not been removed up to this time. One scrubber is used for each battery of ovens and the third is held in reserve. The washed gas is piped to the ovens where it is used in future coking operations. The water after passing through the scrubbers passes to the tar cistern, where it unites with the tar and ammonia, which flow in a steady stream from the settling tank. The tar and ammonia liquor separate in the cistern by gravity, and the latter is removed by decantation.

The tar is treated in sheet iron tanks in which heat is employed to drive off the lighter oils, leaving pitch behind. The former are shipped in tank cars to Philadelphia, where they are broken up, by heat and chemical agencies, into a number of the coal tar products. The pitch is barreled at the plant and is shipped directly to its consumers. The decanted ammonia liquor is treated in a Feldman still, consisting of two cylindrical cast iron tanks, each about 5 feet in diameter. One of them is 30 feet and the other 12 feet high. The lower 12 feet of the former is a single chamber, while the upper 18 feet and the entire smaller tank are of the Bell washer type. The ammonia liquor enters the top compartment of the larger tank and descends from section to section, through an overflow pipe, after filling each one sufficiently to form a water seal about the lower side of the conical bell. Steam passes upward through the compartments and carries with it the free ammonia of the liquor. The steam forces its way from one compartment to the next higher one, by passing through the water seal, and in so doing, it becomes more and more strongly saturated with free ammonia, while the liquor becomes impoverished. By the time that the liquor has reached the large chamber at the bottom of the tank, it contains only the more stable ammonia compounds. These are converted into a solution of free ammonia by means of lime water, which is introduced in a slow stream into the chamber. The liquor, after having been acted upon by the lime, passes through an inverted siphon into the smaller tank, in which the action is entirely similar to that in the upper part of the larger. The ammonia charged steam passes from the top of the smaller tank into the upper part of the larger, and after passing through it as previously described, passes into a condenser. The ammonia is strengthened or diluted to a 20 per cent. solution and shipped in tank cars.

An inspection of the plant, be it ever so brief, cannot fail to convince even a casual observer that its merits are numerous. The coal used does not differ in the slightest degree from that used in the thousands of beehive ovens scattered about the vicinity, yet the yield of coke at the Dunbar plant exceeds that of its neighbors by from 6 per cent. to 8 per cent. Assuming the intermediate figure, the daily yield from 225 tons of coal is 16 tons more than it would be if beehive ovens were employed. The value of the increased output of coke is sufficient to pay almost one-half the wages of the two shifts of 20 men each that are employed in the entire plant. If the coke were appreciably inferior to that produced in beehive ovens, the increased yield would of course be offset, but this is not the case, as four years of its consumption in the Dunbar furnaces have conclusively proved. But in addition to a greatly increased yield of coke, large quantities of valuable by-products, which in the common oven are entirely lost, are obtained. These consist of a solution of ammonia equivalent to 24 pounds of ammonium sulphate, and 10 gallons of crude coal tar per ton of coal. The gas can hardly be considered as a by-product from a commercial point of view, since all of it, with the exception of a small amount which is consumed in lighting the several buildings at the plant, is burned in the flues of the ovens. Before concluding, the writer feels that it would not be amiss to comment upon the cleanliness and the systematic and careful operation of the plant.

[From *Electricity*. Part V.]

The Future of Electric Illumination.[1]

By Mr. Jean Wetmore.

We have not been awake to the inefficiency of our high amperage lighting systems; we do not realize that less than 1 per cent. of the energy from a given source is actually utilized in an incandescent lamp in producing light, and this fundamental fact is ordinarily lost sight of by inventors and investors. There is a loss in the turbine water wheel as well as by incomplete combustion in the boiler furnace, a loss of energy by friction in shafting, heat radiation from boilers, pipes and the engine itself, and an immense amount of heat and unconsumed carbon goes up the smoke stack. There is back pressure in the exhaust of engines, there is a great loss in the conversion of mechanical into electrical energy, there is resistance in electric conductors, and there is an enormously greater loss of energy in producing heat in the incandescent lamp than is used in producing light, and then again there is a large apparent effective loss of light in the present method of suspending the lamps downward towards the center of the room.

The whole lighting system is full of holes through which leaks, at a conservative estimate, over 99 per cent. of our primary energy. Our systems of conversion are extravagantly wasteful.

It is said that our Western abbatoirs utilize every portion of a hog, from its eye teeth through to its tail, except to its squeal, and now it is proposed to make use of the squeal by a phonographic reproduction in children's toys. These economies should be an object lesson to electrical engineers.

The inventor who produces a 2-candle power light where there was but one before, will be a public benefactor, provided some one hundred million dollar electric trust does not pigeonhole the patent to save replacing its present investments, or utilize the saving to pay dividends on highly watered stock.

---

1. *Ante*, p. 207.

As the primary object of this series of articles was to point out the defects of our present system of lighting, with special reference to lamps, wiring and the paraphernalia closely connected therewith, and their bearing on the electric illumination of the future, we will now, as a Frenchman would say, "return to our muttons."

The main object of living is happiness, and to produce discontent and dissatisfaction without trying to indicate the remedy would pro duce a bad impression. We well remember during our school days that one of the so-called evidences of a future life was the universal desire of the human race in that direction; for the last ten years our original electricians have been resting on their well earned laurels or have turned their efforts in other directions; radical improvements are not in order and we do not hear so much nowadays about electricity being in its infancy. Discontent is the forerunner of improvement, and we all know that necessity is the mother of invention. A carping spirit is not the incentive of the writer, but rather to emphasize deficiencies that improvements may be made. We must often tear down before we can build.

Inventors have struck a snag, as they are now often expected to deed over 97½ per cent. of their invention and all the improvements they have not made, and do not own, to a promoter who has no money, in consideration of his promises to do something with an imaginary mysterious individual who has money; and though that imaginary being materializes, the harder the inventor works and the longer he wrestles with the money power, the less he receives, and finally another laurel wreath of bronze is seen in Greenwood Cemetery and another batch of scientific dissertations are printed to be seldom read.

The electrical illumination of the future will probably produce a few more of these benefactors of the human race, these ill-starred "cranks" that turn the wheels of progress.

Our future improvements must fundamentally recognize vibrations as a basic starting point. Every particle of the universe is in a constant state of motion. One single particle in an absolute inert state would mean a universal smash up. Our senses recognize vibrations only; a certain number per second and we feel cold, a certain increase we feel heat, a larger number per second light, and still greater increase and all physiological sensations cease. Where there are a mixed number of vibrations of a certain number each per second, we perceive both heat and light at the same time.

When a piece of iron is placed in the forge it becomes hot; as the particles commence to vibrate faster, a dim glow appears; a further progressive increase in heat, the iron shows colors succeeding each other in a definite succession. The blacksmith takes advantage of this phenomenon to commence forging when the critical color is reached; if the iron is heated still hotter, it becomes incandescent and gives off a white light, thus color is also dependent on a difference of molecular vibration.

If colors depend on varying rates of vibration, and heat vibrations are slower than light vibrations and the iron could be prevented from disintegrating, could not the molecular vibrations be so increased as to be all of them beyond the heat vibrations, leaving nothing but a white light without heat?

This thought is pregnant with possibilities, but there are no practical possibi ities in this direction with iron, granting the hypothetical question. The iron molecules are so closely matted together that they interfere with each other. Tney cannot be made for this reason to vibrate in unison, for some of the vibrations are slowed down and will produce heat, and they cannot from the nature of the substance be all whipped up to the point of unison and maintained at the concert pitch of white light. And so with most all material substances with which we are acquainted, and to such a general extent that we have not learned in common life to disassociate light from heat.

Light without heat is a consummation devoutly to be wished, for if we could electrically convert all the heat vibrations into light vibrations, a wonderful economy in light production would follow, being careful, of course, of not going too far, and by so doing defeat our purpose. In this latter case light would vanish, and radiant energy of a different nature would appear—no, not appear, for it would be of itself alone beyond the reach of our senses. Our clay fettered souls must wait until in that undiscovered realm from which no traveler returns new and higher perceptions are given us.

Astronomers tell us that interstellar space, blacker than Egyptian darkness, long fabled as the blackest of the black, is so because there is nothing in this space to give light vibrations, but nevertheless there are vibrations of some kind that are supposed to reach us from the sun through this interstellar vacuum, and when these vibrations reach the outer confines of our attenuated atmosphere they are slowed down, and this retardation produces light, and finally as they come nearer the heavier atmosphere, and still nearer, among the atmospheric moisture and dust particles, some of these vibrations are so much retarded as to produce heat, and when they strike the dark earth they are converted in a large part into heat vibrations.

If we could go high enough we would perceive a cold light, a light at a temperature of about absolute zero, in fact plenty of light at a temperature far below anything that Tripler has produced by means of liquefied air. Nature has thus, at least, given us an analogy of light production without heat and furnished the raw material in most lavish abundance.

All human achievements are but a manipulation of nature's forces; human as we are, is it not as much in the line of reason to retard vibrations and produce light, without wasting energy in producing heat, as to increase slow molecular action and get the same results with a great loss in heat? Is it not easier to pull down than to build up? Can it be possible that there are not some of these ultra light vibrations reaching us from the sun that are not all slowed down, that are not all strained out by our atmosphere, which we can manipulate by physical means? This is apparently placing the cart before the horse, but there are push carts as well as pull carts, and I believe this method of light production to be worthy of serious thought toward practical ends.

The Chinese produced a civilization long before we built up a civilization, by almost opposite methods. They had their day and we are having ours, and we may yet learn to manipulate vibrations in a direction diametrically opposite to our present well established methods.

The Economics of Long Distance Electric Power Transmission.[1]

[By Mr. Alton D. Adams, M. Am. Inst. Elec. E.]

There has recently come to the hands of the writer the prospectus of a company which wishes to raise funds for the development and electrical transmission of a water power in Western Illinois. The great bulk of the population to whose use it is desired to devote this power is located in cities 40 miles distant from the point where it is to be developed. It is seriously proposed to develop and transmit the water power in question over a distance of 40 miles and sell it in competition with steam power, at points in Western and Central Illinois; and investors are asked to furnish the capital for this enterprise.

Did the above proposition stand an isolated instance, in might well be passed without comment as the chimerical dream of an enthusiast or the obviously fraudulent scheme of a promoter. Unfortunately, the number of propositions similar to the above that are now appearing shows that in many quarters there is current an idea that, given a comparatively cheap source of power it may be profitably conveyed, by the magic of electrical transmission, for a very long distance, and sold in competition with steam power.

As a general proposition nothing could be further from the truth, in spite of the matter that now and then gets into print concerning the electrical transmission to distant cities of power developed from great water falls or banks of waste coal at the mines. It is true, of course, that electric energy can be transmitted over distances that are practically limited only by the possible investment of the promoters. It is equally true that the distances are quite limited over which power can be electrically transmitted and sold at a profit in competition with steam power generated from coal at ordinary prices. The higher the price of coal or the greater the cost of power production, the longer is the distance over which a cheap power may be profitably transmitted. So great, however, is the investment necessary for long distance electrical transmission, and so large the losses of power involved, that with absolutely free mechanical power at the start, the distance to which it can be electrically transmitted and sold at a profit in a district where fuel is as cheap as in Central Illinois, is probably less than 25 miles.

Let the 40-mile transmission proposed in the above prospectus be considered in detail to get an idea of the actual investment required and of the losses incident in the electrical transmission proposed. Starting first with 1 electrical horse power delivered as direct current to low pressure distribution circuits in the town or city where it is to be used, note the total capacity and efficiency of the electrical equipment involved. The chain of electrical elements, beginning at this point, includes a rotary converter, step-down transformer, line, step-up transformer and dynamo. Average efficiencies for each are, rotary converter 90 per cent., transformers each 95 per cent., and dynamo 90 per cent. Any desired loss may be assumed for the line but an efficiency

1. *Engineering News.*

of 90 per cent. is fair for the present case. The total efficiency of the transmission is, therefore, the product of .90 × .95 × .90 × .95 × .90 = .65 per cent.

Hence, for each horse power delivered by the rotary converter to the distribution lines, the dynamo at the distant generating station absorbs 1 ÷ .65 = 1.53 horse power. Taking the capacity of the rotary converter as 1, the capacity of the step down transformer which supplies it is 1. ÷ .90 = 1.11; for the step-up transformer, allowing 90 per cent. efficiency for the line, 1.11 ÷ (.95 × .90) = 1.3; and the capacity of the dynamo is 1.13 ÷ .90 = 1.44 times that of the rotary converter. The combined capacities of the rotary converter and the dynamo are 1 + 1.44 = 2.44 times that of the rotary; and of the transformers, 1.11 + 1.3 = 2.41 times that of the rotary. For each horse power delivered by the rotary to distribution lines, the step-up transformer at the generating station must deliver 1.3 horse power to the transmission line.

The weight of conductors necessary to transmit this rate of work to the step-down transformer, at the rotary converter, will vary inversely as the square of the volts at the line terminals of the step-up transformer, and it is therefore desirable to adopt as high an electric pressure for the transmission as is practical. Climatic conditions have a marked influence on the number of volts it is practical to employ for transmission lines. It is an open question whether more than 10,000 volts can be regularly and satisfactorily used on a 40-mile line in a section having the moist air and heavy rainfall of the Mississippi Valley, and actual experience is lacking to show the amount of trouble to be expected on a line of this extent and pressure in such a territory. Assuming however, as is probably the case, that no very serious difficulty would be had with a line 40 miles long and working at 10,000 volts pressure, the necessary weight of copper wire to transmit each 1.3 horse power delivered to the line by the step-up transformer, at an efficiency of 90 per cent., is about 380 pounds. If it should prove practically possible to operate the above line at double the pressure named, or at 20,000 volts, the weight of copper conductors per horse power delivered by the rotary converter reduces to 95 pounds, one-quarter of the above amount.

The cost of a pole line for these conductors per horse power delivered, is a variable quantity, depending to a large extent on the total amount of power transmitted, but may be taken at approximately $4 per horse power. Dynamos and rotary converters may be fairly taken to cost about $25, and transformers $10 per horse power capacity. An investment in electrical machinery and lines of (2.44 × 25) + (2.41 × 10) + (380 × .20) + 4 = $165.1 per electrical horse power delivered to local supply lines, is therefore necessary for the 40-mile transmission, at 10,000 volts, taking copper line wire at 20 cents per pound. If the line pressure can be raised to 20,000 volts, the item for copper reduces to 95 × .20 = $19, and the investment per delivered horse power is then $108.10.

No satisfactory estimate of the cost to develop the particular water power in question can be made without a large amount of data that is not given. Judging by the investment found necessary at various water powers in favorable locations, the total cost of development, including dams, short canals, water wheels and connections at falls or steep rapids, under 20 feet in height, in favorable locations, should be somewhere from $75 to $150 per horse power developed. Considering the prices paid at a number of well situated water powers, which usually range from $10 to $25 per horse power year, a charge of $15 per horse-power year for power delivered to the dynamos at the generating plant may be fairly assumed. Since, as found above, for each horse power delivered to distribution lines by the rotary converter, 1.53 horse power must be absorbed at the dynamos, the actual cost of water power for each horse-power year supplied to local lines is 15 × 1.53 = $22.95.

The electrical transmission plant will require two buildings, one for the generating station, another at the place where the distributing equipment is located, but as these two buildings may be taken to approximately equal in cost a single building for a steam plant of equivalent power at the point of consumption, any estimate for them may be omitted.

The labor cost of operation for the electric generating and receiving plants, 40 miles apart, and the care of their connecting line may be assumed to equal the labor item in the operation of a steam plant having equivalent power, though this assumption is very favorable to the transmission system.

It only remains now to consider the item of fuel for the steam plant. In Central Illinois, steam coal, of a quality that, with good boilers and compound condensing engines, will develop a brake horse power hour on a consumption of 2.5 pounds can probably be had at less than $2 per ton; but it is here assumed to cost that amount. The fuel cost for a year of 3,000-horse power hours at the engine shaft is therefore (2.5 × 3,000 × 2) ÷ 2,000 = $7.50. Assuming, as before, an efficiency of 90 per cent. for the dynamo driven by this engine, the fuel cost per electric horse power supplied to local lines for distribution is 7.50 ÷ .90 = $8.33 per year. Compound condensing engines with good boilers and all fittings can be erected in large sizes for less than $54 per brake horse power capacity, and the cost of such steam plant per horse power output at electric generator terminals is therefore not more than 54. ÷ .90 = $60. Allowing $25 per horse power for dynamos, the total investment for machinery at the steam driven electric plant is $60 + $25 = $85 per horse power delivery capacity to electric distribution lines.

Comparing now the long distance electric transmission with the steam and electric plant, the transmission line and machinery costs $165.10 at 10,000 volts, or $108.10 at 20,000 volts per delivery capacity of one electrical horse power, while the steam driven electric plant at the place of use costs but $85 for the same capacity. For each horse power year delivered to local distribution lines the charge to the long distance transmission system for water power alone is $22.95, while the charge to the steam driven electric plant is only $8.33 for fuel. Supposing, therefore, that a good water power is already developed and can be had at the wheel shaft for $15 per year, the cost to a transmission system, for a distance of 40 miles, is 22.95 ÷ 8.33 = 2.7 times as great as the fuel cost in a steam plant to deliver the same amount of electric energy at the point of distribution.

In addition to the great disadvantage in the matter of water power and fuel consumption, the long distance electric transmission,s system must pay interest, depreciation and repair charges on from 108.10 ÷ 85 = 1.27 to 165.10 ÷ 85 = 1.94 times as great an investment for the transmission as for the local system. Those familiar with high pressure electric apparatus and lines can hardly doubt that the rate of depreciation and repair charges on them would be as great as for the steam driven electric plant.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

"OBSERVER," writing from Boston, Mass., under date of the 6th inst., says: "The Haverhill (Mass.) gas agitation and the decision thereon have shown the members of the Massachusetts Legislature how easy it is to attract to themselves the attention of their constituents by means of artificial gas. Following the hint a flood of gas investigation orders appeared during the past week. About every city of any size and most of the towns joined the popular cry for investigation, till finally an order was presented calling for an investigation of all the Companies of the state, the findings to be reported to the Legislature on or before April 1st. The text of the order, the paternity of which is traceable to Representative Engstrom, is as follows: 'Ordered, That the Committee on Manufactures be instructed to investigate forthwith the expediency of reducing the price at which gas for heating and illuminating purposes is sold to the consumer in the City of Boston, and that said Committee be hereby requested to report the gross and the net cost of the production and distribution of such gas, together with all details, showing how such cost and prices are arrived; and also copies of all contracts made by any and every corporation or association engaged in the production or distribution of such gas with any other such corporation or association, and also whether there has been any violation of any of the laws of this Commonwealth by any such corporation or association, and, if so, what violations and what measures have been taken to punish or restrain the offenders, together with its recommendations, to the House of Representatives, on or before April 1, 1900. All hearings by said Committee under this order shall be public, and said Committee shall have power to summon persons and papers.' This would seem sufficiently broad to satisfy the most ardent Socialist, and will in one way or another furnish the Board of Gas and Electric Light Commissioners with work for some time to come. No notice having been received from the Haverhill Company of its intentions respecting the recent order of the Commissioners, a formal notice was served upon its proprietors, February 1st, at their office in Haverhill, by the Clerk of the Commission. What the Company will do will probably not be known till it puts out its bills on March 1st, when its price must necessarily be stated. As it cannot obey the order and pay expenses it is inferred that the $1 rate will be adhered to and action in the courts will follow. An order has been introduced to repeal the charter of the Haverhill Gas Light Company. This would seem to discount the action of the Company."

WHILE waiting for a train at the Waltham (Mass) railroad station, early the morning of the 1st inst., Mr. George A. Stearns, Treasurer since 1878 of the Waltham Gas Light Company, died from heart disease. Mr. Stearns, who was 72 years of age, had been prominent in Waltham for almost two score years, and had the complete respect of all who knew him.

AT the annual meeting of the Le Roy (N. Y.) Gas and Electric Company, the officers chosen were: Directors, S. D. Purdy, Butler Ward, R. L. Kinsey, E. A. Wakeman; President, S. D. Purdy; Vice-President and Treasurer, R. L. Kinsey.

OUR issue for January 29th contained an item to the effect that Mr. Thomas H. Hintze had been appointed Superintendent of Works for the Lowell (Mass.) Company. Mr. Hintze, writing from Lowell under date of the 5th inst., referring to that mention, says: "It is true that I have entered the employ of the Lowell Gas Light Company, but in a subordinate position, and I would consider it a favor if you would correct the misstatement"

THE proprietors of the Essex and Hudson Gas Company, of Newark, N. J., have notified the authorities of Bloomfield and Montclair that the new selling rate of $1.10 per 1,000 cubic feet—a concession of 50 cents per 1,000—is to date back to January 1st, 1900.

THE Philadelphia *Times* of recent date had this to say: "The United Gas Improvement Company has filed with the late Controller a statement of the improvements and betterments made by it during the year 1899, as provided in the lease of the gas plant to the Company by the city. This statement, which covers many pages, shows an expenditure on account of improvements and betterments during the year 1899 of $2,473,624.28. During this period the United Gas Improvement Company has been engaged in making changes and improvements decided upon by its engineers as necessary and important. This work may be generally divided between improvement and extension of the manufacturing and storage plant and improvement and extension of the distributing system. At the Point Breeze gas works a new coal gas retort house, 72 feet by 272 feet, containing 324 retorts, or a total maximum capacity of something over 3,000,000 cubic feet per day, which was in process of construction in 1898, has been completed and placed in operation. A new railroad siding has been constructed, the remainder of the old frame coal shed has been replaced by a new shed of corrugated iron, 250 feet long, and the trestle and approaches thereto rebuilt, with 7 tracks instead of 5. Coke conveyors have been erected; and a double, three-story brick dwelling house has been erected on the property for employes' residences. The roadways have been graded, paved with granite, curb set and sidewalks laid, and a chemical laboratory has been equipped. In adition to these improvements a large number of minor improvements, such as additional boilers, engines and new storage tanks for tar, etc., have been added. At the Twenty-fifth Ward Works there is in process of construction a new modern retort house of brick and steel—212 feet by 75 feet—containing 240 retorts of a total maximum capacity of about 2,250,000 cubic feet per day. A new storage holder of 1,500,000 cubic feet capacity has been erected and work commenced on a second holder of the same capacity. At the Market Street holder station there is in course of erection a 2,000,000 cubic feet holder; new underground 30 and 36-inch connections have been put in and a two-story brick building erected on Twenty-second street, to be used as a valve house and testing station for use by the city inspector of meters. At Manayunk a new 150,000 cubic feet holder has been erected. The two testing stations, at Seventeenth street and Passyunk avenue and Richmond and Ann streets, in process of erection in 1898, have been completed, properly equipped and are in service. In the streets there have been laid, approximately, 72 miles of mains to improve the distribution, keeping ahead of the paving operations undertaken by the city, and to supply the many new building operations undertaken during the year. In addition to the amount expended for improvements and betterments during the year, as specified above, viz., $2,473,648.28, there had been expended prior to January 1, 1899, as per report filed with the City Controller, $3,144,162.19, which makes a total expenditure to January 1, 1900, of $5,617,810.47.

THE generating department of the new gas plant for Bremen, Germany, which is to take the place of several small detached stations, is arranged for 30 benches of 9's on the inclined system, with a calculated per diem output of 3,700,000 cubic feet; and for a water gas plant up to a daily output of 4,250,000 cubic feet."

THE Board of Gas and Electric Light Commissioners, of Massachusetts, has authorized the reorganized Lexington Gas and Electric Light Company to issue $25,000 in bonds and $30,000 in stock.

It is reported that the plant and franchises of the Kalamazoo (Mich.) Gas Company have been purchased by the Kalamazoo Valley Electric Company.

THE proprietors of the Columbus (Ind.) Gas Light and Coke Company have applied to the authorities for an extension of their franchise for a period of 30 years. The rate that may be charged for gas is put at $1.50 per 1,000.

THE works of the Newark (N. Y.) Gas Company are in successful operation. Mr. A. F. Jenkins, under whose supervision the works were conducted, has been appointed permanent Superintendent for the Company.

IT is likely that the selling rate will soon be put at 80 cents per 1,000 cubic feet by the authorities in charge of the Richmond (Va.) municipal gas plant. The prevailing rate of $1 per 1,000 has been in effect since October, 1893. Our correspondent in this instance declares that such a step should undoubtedly be taken, in that the lines of the ordinances governing the department clearly state that the price of gas shall be so regulated as to produce, over and above expenses, only so much as shall be necessary to pay interest on plant investment, at a valuation of $1,000,000, rated at 4 per cent. per annum. Last year the plant yielded an operating profit of $87,000. Four per cent. interest on $1,000,000 amounts to $40,000, hence the sum of $47,000 remained. This surplus, it is contended, should be wiped out by reducing the price to consumers.

IT is said that Camden (N. J.) and Philadelphia capitalists contemplate the erection of a gas plant at Ocean City, N. J.

THE Anniston (Ala.) Electric and Gas Company proposes to extend its pipes and wires to the borough of Oxford, 3 miles south of the first named place.

MR. WILLIAM P. TAYLOR, Treasurer of the Wilmington (Del.) Coal Gas Company, has notified the shareholders that the regular semi-annual dividend of $3 per share is payable on demand.

MR. Z. T. F. RUNNER, the popular and efficient Secretary and General Manager of the Freeport (Ills.) Light and Fuel Company, has been booming gas through the medium of the local press. A recent issue of the Freeport *Daily Bulletin* carries a half-page advertisement, noting plainly what the Company is disposed to do to help the residents and itself. Part of the advertisement is allotted to the Company's fifth annual "special sale of gas ranges, heaters and other gas appliances, commencing February 1st and closing April 30th, 1900," and from it we learn these things in respect of the Company's practice: To all residing on the present lines of its street mains, and not now using gas for cooking, the Company will give 5,000 cubic feet of gas free w th each of the first 50 ranges sold; 4,000 cubic feet with each of the second 50 ranges sold; 3,000 cubic feet of gas with each additional range sold during the special sale. The gas given away "is not transferable," and must be used with the range with which it is given prior to September 1, 1900. All of which is quite a scheme.

BUT Manager Runner has another string to his bow for convincing the residents of Freeport that gas is a pretty good thing to have and to use. "The other string" is in the shape or form of the following notice: "*Cheaper Gas.*—April 1st, 1900, will mark the 5th anniversary of the present ownership of the Freeport gas works. This anniversary will be memorable, as a reduction in the price of gas will take effect on that date. The reduction which we now announce will be as follows: A discount of 10 cents per 1,000 from the present rate of $1.35 will be given on all bills paid at our office during the first 5 days of the month following date of bill, making the net rate $1.25 per 1,000." Enough said.

MR. A. P. LATHROP, whose removal from Columbus, Ohio, where he had been Secretary and Treasurer of the Columbus Gas Company, to St. Paul, Minn., where he is to serve as President and General Manager of the St. Paul Gas Company, was pleasantly remembered by those who worked under him in the Capital of the Buckeye State. He was the recipient of several handsome gifts, the presentations of which were marked by much kindly feeling, if expression and acts go for anything.

(*Continued on page 254.*)

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.
PACIFIC COAST GAS ASSOCIATION.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co. 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, FEB. 12, 1900.

(*Continued from page* 253.)

AN attempt is being made to rehabilitate the finances and plant of the Salisbury (N. C.) Gas and Electric Light Company.

AT the annual meeting of the shareholders in the Houston (Texas) Gas Light Company the officers chosen were: Directors, T. W. House, J. A. Baker, Jr., Henry C. Fox. and J. H. B. House. President, T. W. House; Vice-President, T. H. Scanlan; General Manager, J. J. McKeever, Sr.; Superintendent, J. H. Fitzgerald.

IT is again proposed to establish a gas works in Manchester, Va., which place is opposite Richmond. The main parties to the proposition are Messrs. A. L. Adamson, H. C. Beattie, A. J. Daffron, George E. Carey and A. D. Shotwell, of Manchester.

MR. C. S. RITTER, heretofore Chief Clerk in the office of the Columbus (Ohio) Gas Company, succeeds Mr. A. P. Lathrop as its Secretary. Mr. Irvin Butterworth, President and General Manager of the Company, assumes in addition the duties of its Treasurer.

WRITING of Mr. Butterworth recalls the fact that at the annual meeting of the Engineers' Club, of Columbus, he was elected its President.

MESSRS. HOWARD L. OLDS, Wm. H. Odiorne and Edward F. Irwin have applied for letters incorporating the Clinton (Ills.) Gas Company It is capitalized in $50,000. This place is the capital of De Witt county, Ills., and is situated on the Illinois Central Railroad at a point 22 miles south of Bloomington and 22 miles north of Decatur. It is noted for its manufactures of small wares, wagons, pumps, etc., has a population of perhaps 4,000, and is quite a busy place.

ALDERMAN MCLEAN seems very anxious to engage the City of Holyoke, Mass., in the operation of a municipal lighting plant, but his arguments seem to have comparatively little weight with his fellow Aldermen, who are apparently disposed to act with some sort of justice towards the Holyoke Water Power Company, which controls the Holyoke gas works.

W. C. MCFARLAND and others have incorporated a concern known as the Cleveland Gas and Illuminating Company, with a view to making and selling gas in Cleveland, Ohio. And Cleveland has the distinction of being supplied with an excellent article of illuminating gas at a rate less than 77 cents per 1,000! Mr. McFarland must be jesting.

A RECENT issue of the Louisville, (Ky.) *Times* had this to say: "Mr. J. H. Hoertz, official gas inspector for Louisville, has submitted his annual report to the City Council regarding the operations of his department for year ended December 31, 1899. He says that the Company furnished an excellent quality of gas during the year, the average candle power being 19 21, whereas the Statute calls for 16 candles. At no time did the candle power fall below the minimum, the lowest being 17.11 and the highest 22.66. The average was better than during 1898. There have been complaints made about the quality of the gas, but this is often found to be due to water in the meter, defective burners, etc. The inspector makes daily tests and finds that the Company has complied with all of its requirements, there being less sulphur, ammonia and other foreign substances than the contract and charter permit. Of the 868 meters tested 678 were new ones furnished by the Company and 198 meters were tested on complaint of consumers. Of the 190 complained of 56 were too fast, the average error being 2.08 per cent.; 120 were slow, the average error being 3.55 per cent., and 11 of those complained of were correct. All of the new meters passed inspection except one and this one was correctly adjusted. The fastest meter found during the year was 8 per cent., and the slowest 45 per cent. All meters passing inspection are sealed, and a record is kept in the office. At the beginning of the year there were 10 gas lamps in the city street lighting service, but these have been discontinued, and electric lamps substituted. The total cost of street lighting by gas lamps was $42.91 for the year. During the year 77 arc lamps were erected, making a total of 1,523 in the service, December 31, 1899, and the total cost of such lighting was $124,094.23 for the year. The cost per lamp per annum is $84 for 2,000-candle power lamps. During the year the lamps were out 1,439 hours, and the amount of the outage was $53.20, which was less than in 1898, when the amount deducted was $72. The total cost of gas consumed in public buildings during the year was $5,549.45, $121.07 of which was for fuel purposes. All of the meters used by the city have been tested and have been found to be correct. The total cost of electric lighting in the City Hall during the year was $1,432.08. All bills are inspected and made a matter of record. The inspector furnishes a detailed statement of his work during the year, giving exhibits of tests in schedules and tables."

The Market for Gas Securities.

The market for city gas shares last week was not marked by anything of moment, save towards the close yesterday (the 8th inst.), when Consolidated moved up quickly to 194. Some sales were made in it at 194 to-day, and the closing was reported at 192½ to 193. The 65-cent rate prevails, much to the chagrin of the legislators, who are not disposed to be pleased with such a low figure, since through its operation they know that many of their golden opportunities are as 1 is to 16. Meanwhile the bald fact remains that gas at 65 cents per 1,000 is not over conducive to the golden dreams that were the portion of the gas makers in the days of yore. At Albany many odd bills have been introduced which are presumed to affect the gas interests in one way or another, but calm thought induces the belief that there is or will be "nothing doing" in the chief offices of the State this year that will hurt or even harm the gas industry of Greater New York.

The signs of the hour are that certain local forces hitherto inimical to the Irving Place dynasty have virtually agreed to capitulate "honorably." New Amsterdams are like last week, while Standards show a hardening tendency. The shares of the latter are cheap at quoted prices

Brooklyn Union remains steady, and is cheap at the price named. Peoples, of Chicago, keeps going along towards it real value, which is not a cent less than 125; Bay State is back to 2; Baltimore Consolidated is stronger, but cheap at ruling quotations. Laclede common is unaccountably weak, and Buffalo's are unaccountably strong. Western, of Milwaukee, still looks to us a purchase.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

FEB. 12.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	192½	194¼
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	18
Metropolitan Bonds	658,000	.	108	112
Mutual	8,500,000	100	2?5	300
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	
New Amsterdam Gas Co.	13,000,000	100	25½	26¼
Preferred	10,000,000	100	46	48
Bonds, 5's	11,000,000	1,000	97	98½
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	115	..
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	
Standard	5,000,000	100	115	125
Preferred	5,000,000	100	140	150
Bonds, 1st Mortgage, 5's	1,500,000	1,000	110	114
Yonkers	299,65	500	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	149	150
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	2	2½
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works..	450,000	100	40	..
" 1st Mtg. 5's	475,000	1,000	96½	99½
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	

Buffalo City Gas Co.	5,500,000	100	5	8
" " Bonds, 5's	5,250,000	1,000	72	75
Central, San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000	106	108
Columbus (O.) Gas Lt. & Heating Co	1,682,780	100	60	65
Preferred	3,026,500	100	84	86
Consumers. Jersey City Bonds	600,090	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	193½	194½
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Consolidated. Baltimore	11,000,000	100	58¾	59
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	21	23
" Con. Mtg. 5's	380,000	1,000	87	90
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,560,000	50	95¾	96
" Prior Lien 5's	4,598,000	1,000	99½	100
Detroit Gas Co., 5's	386,000	1,000	100	101
" Inc. 5's	16,000	100	100½	101
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	38	45
" Bonds	2,000,000	..	60	64
Grand Rapids Gas Lt. Co.	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	102	105
Indianapolis	2,000,000	..	100	105
" Bonds, 6's	2 650,000	..	101	103
Jackson Gas Co	250,000	50	72	78
" 1st Mtg. 5's	250,000	1,000	101	102½
Lafayette Gas Co., Ind.	1,000,000	100	40	45
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	106	
Laclede, St. Louis	7,500,000	100	76	..
Preferred	2,500,000	100	95	101
Bonds	10,000,000	1,000	110	110½
Madison Gas & Elec. Co.	400,000	100	82	..
" 1st Mtg. 6's	350,000	1,000	102½	108
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co	16,000,000	..	50	60
Bonds, 6's	4,600,000	..	107	108
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	43	45
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	108	108¼
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	111⅜	111½x
2d "	2,500.000	1,000	104	105
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	49	50
St. Paul Gas Light Co	1,500,000	100	57½	58½
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	88	90½
St. Joseph Gas Co	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	..	15
Bonds	1,612 000	1,000	85	90
Washington, D. C	2,000,000	20	285	..
First mortgage 6's	600,000	..	.	..
Western, Milwaukee	4,000,000	100	106¾	107¾
Bonds, 5's	3,830,500	.	106	108
Wilmington, Del.	600,000		220	50

Advertisers' Index.

GAS ENGINEERS.

	Page
Wm. Henry White, New York City	275
Fred. Bredel, Milwaukee, Wis.	262
Geo. R. Rowland, New York City	278
The Western Gas Construction Co., Fort Wayne, Ind.	280
Humphreys & Glasgow, New York City	274
American Gas Co., Phila., Pa.	262
David Leavitt Hough, New York City	272
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	259
Baxter & Young, Detroit, Mich	272
United Gas Improvement Co., Phila., Pa	267
James T. Lynn, Detroit, Mich	272
A. E. Boardman, Brevard, N. C	272
James R. Floyd's Sons, New York City	276
Continental Iron Works, Brooklyn, N. Y.	274
Deily & Fowler, Phila., Pa.	276
Kerr Murray Mfg. Co., Fort Wayne, Ind	272
Stacey Mfg. Co., Cincinnati, Ohio	275
Bartlett, Hayward & Co., Baltimore, Md.	273
Davis and Farnum Mfg. Co., Waltham, Mass.	272
R. D. Wood & Co., Phila., Pa.	274
Isbell-Porter Company, New York City	274
Fred. Bredel, Milwaukee, Wis.	262
United Gas Improvement Co., Phila., Pa.	267
National Gas and Water Co., Chicago, Ills.	269
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	259
The Western Gas Construction Co., Fort Wayne, Ind.	280
Humphreys & Glasgow, New York City	273
American Gas Co., Phila., Pa.	262
Logan Iron Works, Brooklyn, N. Y.	276
Riter-Conley Mfg. Co., Pittsburgh, Pa.	275
Baxter & Young, Detroit, Mich	272
Berlin Iron Bridge Co., East Berlin, Conn	261
G. Shepard Page's Sons, New York City	272
James T. Lynn, Detroit, Mich	272
A. E. Boardman, Brevard, N. C.	272
Sutherland Construction & Improvement Co., N.Y. City	260
Chris. Cunningham & Son, Brooklyn, N.Y.	257

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md.	273
United Gas Improvement Co., Phila., Pa.	267
Burdett Loomis, Hartford, Conn.	274
National Gas and Water Co., Chicago, Ills.	269
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	259
The Western Gas Construction Co., Fort Wayne, Ind.	280
Humphreys & Glasgow, New York City	273
Sutherland Construction & Improvement Co., N.Y. City	260
B. E. Chollar, St. Louis, Mo.	260

SCRUBBERS AND CONDENSERS.

R. D. Wood & Co., Phila., Pa	274
James R. Floyd's Sons, New York City	276
Continental Iron Works, Brooklyn, N. Y.	274
Logan Iron Works, Brooklyn, N. Y.	276
Riter-Conley Mfg. Co., Pittsburgh, Pa.	275

TAR AND CARBONIC ACID EXTRACTOR.

R. D. Wood & Co., Phila., Pa	274

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich.	256
American Gas Company, Phila., Pa.	262

GAS METERS.

John J. Griffin & Co., Phila., Pa.	240
American Meter Co., New York and Philadelphia	279
Helme & McIlhenny, Phila., Pa.	279
D. McDonald & Co., Albany, N.Y.	277
Nathaniel Tufts Meter Co., Boston, Mass.	278
Maryland Meter and Mfg. Co., Baltimore, Md.	278
Metric Metal Co., Erie, Pa	279
Keystone Meter Co., Royersford, Pa.	278
Detroit Meter Company, Detroit, Mich.	279

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia	279
John J. Griffin & Co., Phila., Pa.	240
D. McDonald & Co., Albany, N. Y.	277
Helme & McIlhenny, Phila., Pa.	279
Nathaniel Tufts Meter Co., Boston, Mass.	278

GAS AND WATER PIPES.

M. J. Drummond & Co., New York City	277
R. D. Wood & Co., Phila., Pa.	274
Warren Foundry and Machine Co., New York City	277
Donaldson Iron Co., Emaus, Pa.	277
Chris. Cunningham & Son, Brooklyn, N.Y.	257

PIPE CUTTERS.

The Anderson Pipe Cutter Co., East Boston, Mass.	259

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N. Y. City	259

GAS TAPPING MACHINES.

George Light, Dayton, O.	256

FLEXIBLE JOINTS.

Campbell Mfg. Co., Stamford, Conn	214

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, Brooklyn, N. Y.	269

GAS COALS.

Penn Gas Coal Co., Phila., Pa.	271
Perkins & Co., New York City	270
Despard Gas Coal Co., Baltimore, Md.	271
Westmoreland Coal Co., Phila., Pa.	271
Berwind-White Coal Mining Co., New York and Phila.	270

CANNEL COALS.

Perkins & Co., New York City	270

CONVEYORS.

The Link-Belt Machinery Co., Chicago, Ills	259

GAS ENRICHERS.

Standard Oil Co., New York City	271
The Sun Oil Co., Pittsburgh, Pa.	271

COKE CRUSHER.

C. M. Keller, Columbus, Ind.	271

GAS GAUGES.

The Bristol Co., Waterbury, Conn.	261

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City	269
Isbell-Porter Co., New York City	274
R. D. Wood & Co., Phila., Pa.	274
Wm. M. Crane Co., New York City	258

CEMENTS.

C. L. Gerould, Galesburg, Ills	238

RETORTS AND FIREBRICKS.

J. H. Gautier & Co., Jersey City, N. J.	268
Adam Weber, New York City	268
Laclede Firebrick Mfg. Co., St. Louis, Mo.	268
Cyrus Borgner, Phila., Pa.	268
James Gardner, Jr., Pittsburgh, Pa.	268
Henry Maurer & Son, New York City	268
Baltimore Retort and Firebrick Co., Baltimore, Md.	268
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	268
Brooklyn Firebrick Works, Brooklyn, N. Y.	268

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md.	273
Fred. Bredel, Milwaukee, Wis.	262
J. H. Gautier & Co., Jersey City, N. J.	268
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	268
Adam Weber, New York City	268

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Co., New York City	274
Continental Iron Works, Brooklyn, N.Y.	274
Logan Iron Works, Brooklyn, N. Y.	276
R. D. Wood & Co., Phila., Pa.	274

INCANDESCENT GAS LAMPS.

Welsbach Commercial Co., Phila., Pa.	266

BURNERS.

C. A. Gefrorer, Phila., Pa.	274
Wm. M. Crane Co., New York City	258
D. M. Steward Mfg. Co., Chattanooga, Tenn.	259

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn.	259

STREET LAMPS.

Welsbach Street Lighting Co., New York and Phila.	264
Thos. T. W. Miner, New York City	256

PURIFIERS.

Stacey Mfg. Co., Cincinnati, O.	260

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City	269

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y.	261
Chapman Valve Manufacturing Co., Boston, Mass.	261
R. D. Wood & Co., Phila., Pa.	274
Continental Iron Works, Brooklyn, N. Y.	274
The P. H. & F. M. Roots Co., Connersville, Ind.	263
Isbell-Porter Co., New York City	274
The Western Gas Construction Co., Fort Wayne Ind.	280

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind.	263
Isbell-Porter Company, New York City	274
Connelly Iron Sponge and Governor Co., New York City	269

ELECTRICAL APPARATUS.

Wm. Henry White, New York City	275

ENGINES AND BOILERS.

The Hazelton Boiler Company, New York City	259

PURIFIER SCREENS.

John Cabot, New York City	261

GAS STOVES.

American Meter Co., New York and Philadelphia 265
Maryland Meter and Manufacturing Co., Baltimore, Md. 278
Keystone Meter Co., Royersford, Pa..... 278
Wm. M. Crane Co., New York City..... 258
Nathaniel Tufts Meter Co., Boston Mass..... 278
National Stoves, Lorain, O..... 256
Abendroth Brothers, Port Chester, N. Y..... 257
Detroit Stove Works, Detroit, Mich..... 216

HOT WATER HEATERS.

Wm. M. Crane Co., New York City..... 258

GASHOLDER TANKS.

J P. Whittier, Brooklyn, N. Y..... 273

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 273
Continental Iron Works, Brooklyn, N. Y..... 274
Deily & Fowler, Philadelphia, Pa..... 276
Davis & Farnum Mfg. Co., Waltham, Mass..... 272
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 272
Stacey Mfg. Co., Cincinnati, Ohio..... 275
R. D. Wood & Co., Philadelphia, Pa..... 274
Logan Iron Works, Brooklyn, N. Y..... 276
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 275
Chris. Cunningham & Son, Brooklyn, N.Y..... 257

GAS SECURITIES.

Henry Marquand & Co., New York City..... 257

ADVERTISING.

J. Howland Harding, New York City..... 257

BOOKS, ETC.

Newbigging's Handbook..... 264
Field's Analysis, 1898..... 221
Scientific Books..... 270
Digest of Gas Cases..... 271
Practical Photometry..... 268
Gas Flow Computers..... 278
Hughes' "Gas Works"..... 269
Gas Engineer's Pocket-Book..... 220
Excerpts from Reports of Gas Commissioners..... 238
Poole on Fuels 239
Binders..... 277
Directory of Gas Companies 275
Practical Handbook on Gas Engines..... 264
Coal Tar Tree..... 260

WANTED,

Position as Superintendent or Manager

Of coal or water gas plant. Young, energetic and a good gas seller. At present in charge of plant sending out 25,000,000 per annum. Good references.

1288-1 Address "W. T.," care this Journal.

POSITION WANTED

As Superintendent of Gas Works.

Am open for engagement as Superintendent of coal or water gas works. Nine years' experience. Now is the time to put a man in to push sales of gas through stoves and appliances. A good record for this kind of work and excellent references. Address "U. N.,"

1288-1 Care this Journal.

POSITION WANTED

As Superintendent of Gas Works,

By a competent, all-around gas man, who has had several years' experience.

1287-4 Address "A.," care this Journal.

Position Wanted

In a Coal or Water Gas Works.

A good business man, with 15 years' experience in both water and coal gas plants, wants to get position where a hustler will be appreciated. Is particularly well fitted to increase the business and build up old plants. Have the best of references, including present employer.

1286-5 Address "W. L.," care this Journal.

Position Wanted

As Manager or Engineer of a Gas Company.

A Thoroughly Competent Gas Manager of many years' experience in the manufacturing and the executive ends of a Gas Company desires a position as Manager or Engineer of a Gas Company selling not less than 50,000,000 cubic feet per annum. Highest references given. Address "T.,"

1267-tf Care this Journal.

WANTED,

Cast Iron, D-Shape, Hydraulic Main, Stand Pipes, Mouthpieces and Ironwork for 8 Benches of 48 D-Retorts.

Address **"C. E. S."**

106 W 103d St., New York.

1287-2

FOR SALE

And Immediate Delivery at Harlem Station Gas Works, 111th Street and 1st Avenue, New York City:

Two Gas Exhausters, Isbell & Porter, manufacturers. Each 150,000 cubic feet capacity per hour, with four gate valves and connections, bye pass and compensator.

Two Continental Iron Works Beam Engine Eyes, 12-inch by 18-inch stroke, with gas governors. One Fresby clutch shaft with pulleys and belts. Room 32 by 36 feet.

One Vertical Scrubber, Continental Iron Works, manufacturers, 14 feet diameter, 32 feet high, with 12 stationary and 12 revolving trays operated from underneath; also overhead truck connection, 20-inch, capacity 1,000,000 feet.

One Horizontal Eclipse Scrubber, English manufacture, capacity 2,000,000 feet. Length 17 feet 2 inches, width 7 feet 6 inches, height 7 feet 6 inches. Connection and valves 20-inch; also wall countershaft and gearing.

Two Horizontal Boilers, 48 inches by 12 feet, with 43 tubes 3½ inch. Complete with ornamental fronts, stays and ties, and all fittings; also iron roof frame, 30 feet by 24 feet.

One Iron Water Tank, 20 feet diameter, 30 feet high, resting on six 15-inch T-beams.

A Worthington Compound Duplex Steam Pump, with all fittings, and an iron ladder 65 feet high.

A Composite Roof Frame composed of nine trusses with yellow pine rafters and iron twist members. All for a room 57⅓ feet by 121 feet inside.

A Quantity of Cast Iron Wall-Light Boxes.

☞ All above materials are in excellent condition, having been used less than two years. For terms, etc., apply to

J. REEBER'S SONS,

1287-1 107th St. & East River, New York City.

For Sale.

A Small Gas and Electric Light Plant,

in a Southern city of 3,800 inhabitants.

Address FORT WAYNE ELECTRIC CORPORATION,

1097-tf Fort Wayne, Ind.

Backus Gas Heaters at ¼ Cost Price!

We have for sale, at one-fourth cost price, a lot of Backus Gas Heaters. Most of them have never been used. Write for list and particulars.

THE COLUMBUS GAS COMPANY,
COLUMBUS, O.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

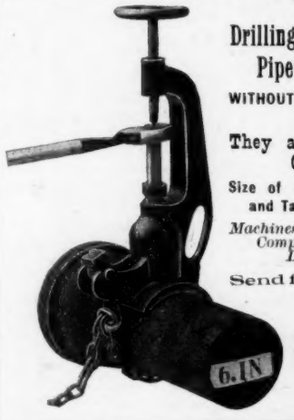
WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.



Geo. Light,
DAYTON, O.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator,

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or Mich. Ammonia Works. Detroit, Mich.

"THE MINER"

Globe Street and Boulevard Lamps.

Cheapest and Best.

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.

DIRECT ACTION GAS RANGE

Is the Most Economical Gas Consumer on the Market.

We can and will prove this to you if you desire. SEVEN FEET OF GAS will turn out a baking of biscuits well done. Write us, we can save you some trouble.

"NATIONAL STOVES,"

LORAIN, OHIO.

King's Treatise

A second hand set of King's Treatise, in good order, wanted by

"ENGINEER," care this Journal.

PLANS ADVICE WRITING ILLUSTRATING

J. HOWLAND HARDING, ADVERTISING, 1545 BROADWAY LONG ACRE SQUARE NEW YORK

HENRY MARQUAND & CO.,

BANKERS

AND

BROKERS.

160 Broadway, New York City.

YORK GAS RANGE,

Possessing Features Found in No Other.

HIGH IN EFFICIENCY,
HANDSOME IN DESIGN.

The construction of our oven for 1900 is entirely new, BEING QUICK and ECONOMICAL.

Our New Catalogue is now ready, if you have not received a copy, send us your name and address and we will be pleased to send you copy.

ABENDROTH BROS.,

109-111 Beekman St., New York City. Port Chester, N. Y.

CHRIS. CUNNINGHAM & SON,

PROPRIETORS,

THE NOVELTY STEAM BOILER WORKS,

BROOKLYN, N. Y.

STORAGE TANKS FOR GAS WORKS,

To Retain Fluid Material of Any Sort.

PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America Stands as Reference.

Bray Burners are the Standard of Merit.

Union Jet Special.

USED IN EVERY COUNTRY IN THE GLOBE—
SHOULD BE KEPT IN STOCK BY EVERY GAS COMPANY.

Because they are adapted to all conditions of pressure and quality. They are so carefully made and of the best materials that they are indestructible with ordinary usage.

They are manufactured in styles and sizes to suit all conditions—for all kinds of Gas.

For use in house, market or shop.

"Gem" Self-Lighter fitted with the BRAY BURNER for Halls, Bath Rooms or Cellars.

The only factory where burners are made in all their parts.

The Enamel of the BRAY BURNER tips is much harder and more durable than "Steatite," of which the so-called "lava" tips are made.

The BRAY BURNER will yield the maximum candle power from a cubic foot of gas.

Gem Self-Lighting Burner with Bray Regulator (or Tip).

Acetylene Tip.

A Significant Fact The cities of NEW YORK, CHICAGO and many other large cities of the United States and many foreign countries have adopted the BRAY SPECIAL for general use.

The MAJORITY of Gas Companies have adopted the BRAY BURNER as the standard for testing purposes.

Market Burner.

Regulator.

Bray's "Special" Burners are superior to any other for general use. All the "Special" Burners are fitted with checks that cannot be tampered with.

Send for our "Blue Book" and Price List, free.

W. M. Crane Company

Sole Agents for the United States,

1131-1133 BROADWAY, - - NEW YORK.

Brass Pillar for Regulator.

THE THOMAS DAY COMPANY, San Francisco, Cal.,
Distributing Agents for Pacific Coast.

Slit Union Special.

W. H. PEARSON, Prest. W. H. PEARSON, Jr., Vice-President. J. T. WESTCOTT, M.E., Manager. L. L. MERRIFIELD, M.Inst.M.E., Chief Engineer.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION CO., LD.

American Offices: 269 FRONT STREET, EAST, TORONTO, ONT.
London Offices: 19 ABINGDON STREET, WESTMINSTER, S.W.

Telegraphic Address: "CARBURETED LONDON AND TORONTO."

The above Company have erected since 1893, or are now erecting, their universal type of Carbureted Water Gas Plants at the following Gas Works:

	Cubic Feet Daily.
Blackburn, Eng.	1,250,000
Windsor Street Works, Birmingham, Eng.	2,000,000
Saltley Works, Birmingham, Eng.	2,000,000
Colchester, Eng.	300,000
Birkenhead, Eng.	2,250,000
Swindon (New Swindon Gas Co.), Eng.	120,000
Saltley Works, Birmingham, Eng. (2d Contract)	2,000,000
Windsor St. W'ks, Birming'm, Eng. (2d Contract)	2,000,000
Halifax, Eng.	1,000,000
Toronto,	250,000
Ottawa,	250,000
Toronto (Second Contract, Remodeled),	2,000,000
Lindsay (Remodeled),	125,000
Belleville,	250,000
Ottawa (Second Contract),	250,000
Brantford (Remodeled)	200,000
St. Catherine's (Remodeled),	250,000
Kingston, Pa.	125,000
Montreal,	500,000
Peterborough, Ont.	250,000
Wilkesbarre, Pa.	750,000
St. Catherine's (Second Contract),	250,000
Buffalo, N. Y.	2,000,000
Winnipeg, Man.	500,000
Colchester, Eng. (Second Contract),	300,000
York, Eng.	750,000
Rochester, Eng.	500,000
Kingston, Ont.	300,000
Crystal Palace District, Eng.	2,000,000
Duluth, Minn.	300,000
Caterham, Eng.	150,000
Enschede, Holland,	150,000
Leicester, Eng.	2,000,000
Buenos Ayres (River Platte Co.),	700,000
Burnley, Eng.	1 500,000

PHOTOMETRIC

Tests made by the EXPERTS of

New York, Chicago

and other large cities, give

Steward's Burners

HIGHER CANDLE POWER THAN ANY OTHER UNION JET BURNER.

The D. M. Steward Mfg. Co.,

New York Office, 107 CHAMBERS ST.

CHATTANOOGA, Tenn.

REMOVAL NOTICE.

The Hazelton Boiler Company

have removed to their NEW WORKS at Rutherford, New Jersey.
Please address all communications to the Company at their New Office, 120 Liberty Street, N. Y. City.

THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.

Will cut from 2 in. to 24 in.
Pipe Cutting Tool

For Cutting Cast, Wrought Iron, Gas & Water Pipes.

THE ANDERSON PIPE CUTTER COMPANY, Manufacturers, 163 Liverpool st., E. Boston, Mass
N. Y. Office, 135 Greenwich St.
C. H. TUCKER, JR., Manager.
WALDO BROS., 102 Milk Street, Boston, Mass.

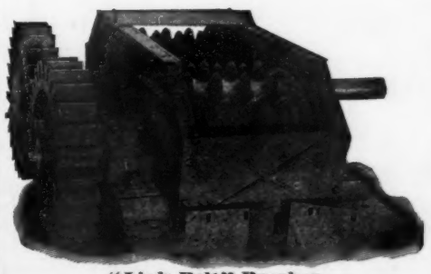
SAFETY GAS MAIN STOPPER CO.

211-E. 116 TH ST. N.Y.

FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS

THE LINK-BELT MACHINERY CO.,

ENGINEERS, FOUNDERS, MACHINISTS,
Chicago, U. S. A.



"Link-Belt" Breaker.

LINK-BELT ELEVATING & CONVEYING MACHINERY for HANDLING COAL, COKE, OXIDE, ETC

Tilting Coal and Coke Cars,
Breaker Rolls, Shaking Screens,
Power Transmitting Machinery

Machinery designed and erected to suit existing conditions and available space.

CATALOGUE UPON APPLICATION

Sutherland Construction & Improvement Co.

Offices: 15 WALL ST., NEW YORK, and OSHKOSH, WISCONSIN.

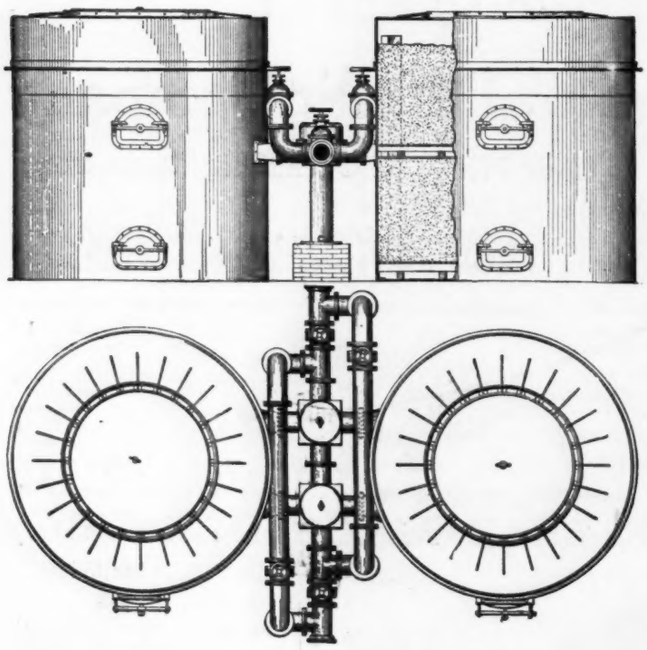
Owners of the "SUTHERLAND" Patents for Water Gas Apparatus.

Gas, Electric Light, Water Works, and Electric Street Railways Built, Remodeled, Operated, Bought and Sold.

A few of the places where the SUTHERLAND Apparatus is in successful operation:

Ilion, N. Y.
Herkimer, N. Y., 2 orders.
Little Falls, N. Y.
Fishkill-on-Hudson, 2 orders.
Clifton Springs, N.Y., 2 orders.
Green Bay, Wis.
Stevens Point, Wis.
Tarrytown, N.Y., 3 orders.
Ft. Henry, N. Y.
Gainsville, Fla.
Hollidaysburg, Pa.
Waterville, N. Y.
Huntington, L. I.
Lexington, Mo.
Mendota, Ill.
Circleville, O.
Joplin, Mo.
Ashville, N. C.
Youngstown, O.
Kingston & Rondout, N. Y.

CORRESPONDENCE SOLICITED.



CHOLLAR'S SYSTEM OF GAS PURIFICATION.

Covered by Five U.S. Patents.

In operation, revivification of the oxide is effected by repeated reversals of the direction of the flow of the gas through the beds (in the two boxes used under this system there are eight different routes for the gas to take) whereby the purified gas is made to revive the oxide in parts of the apparatus while the foul gas is fouling it in others.

The boxes are charged or discharged from the sides as well as the top.

There are no Hydraulic Cups or heavy covers.

Either end of the apparatus is inlet or outlet at pleasure.

The capacity is increased five-fold or more over ordinary methods without addition to building.

The apparatus costs less than for any other system.

For Estimates Write **The Stacey Mfg. Co.,**
SOLE MANUFACTURERS,
CINCINNATI, OHIO.

FOR FURTHER INFORMATION WRITE
B. E. CHOLLAR, 411 N. 11th St., St. Louis, Mo.

Coal Tar Genealogical Tree.

Mr. T. Viner Clarke, of London, Eng., having compiled a novel Chart or Map illustrating the various CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR, in the form of a Genealogical Tree, including all the products discovered (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., No. 32 Pine Street, New York

WE HAVE IN STOCK

At East Berlin, Conn., about 10,000 tons of Beams, Channels, Angles, Plates, etc., as follows:

CHANNELS.

92	bars	.	3-inch	.	4	pounds	per	ft.
87	"	.	4	"	.	$5\frac{1}{4}$	"	"
160	"	.	5	"	.	$6\frac{1}{2}$	"	"
219	"	.	6	"	.	8	"	"
176	"	.	7	"	.	$9\frac{3}{4}$	"	"
291	"	.	8	"	.	$11\frac{1}{4}$	"	"
97	"	.	9	"	.	13	"	"
116	"	.	10	"	.	15	"	"
87	"	.	10	"	.	16	"	"
110	"	.	12	"	.	$20\frac{1}{2}$	"	"

I BEAMS.

101	bars	.	3-inch	.	$5\frac{1}{2}$	pounds	per	ft.
216	"	.	4	"	.	$7\frac{1}{2}$	"	"
110	"	.	5	"	.	$9\frac{3}{4}$	"	"
87	"	.	6	"	.	$12\frac{1}{4}$	"	"
191	"	.	7	"	.	15	"	"
116	"	.	8	"	.	$17\frac{1}{2}$	"	"
127	"	.	9	"	.	21	"	"
114	"	.	10	"	.	25	"	"
87	"	.	12	"	.	$31\frac{1}{2}$	"	"
62	"	.	12	"	.	40	"	"
101	"	.	15	"	.	42	"	"
175	"	.	15	"	.	50	"	"
42	"	.	15	"	.	60	"	"
160	"	.	20	"	.	65	"	"

In addition we also have all sizes of Angles both with even and uneven legs, from 1 x 1 x $\frac{1}{8}$ in. to 6 x 6 x $\frac{3}{4}$ in., and Plates from 6 in. to 60 in. in width. We also have a fair stock of Zee bars, Tee iron and special shapes. All of this material in lengths from 40 ft. to 50 ft. We can ship promptly, and should be pleased to receive your order. Prices on Application.

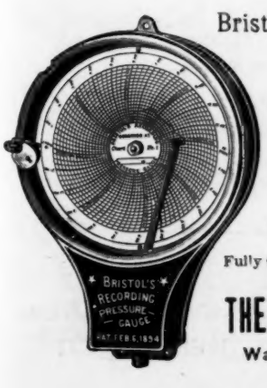
THE BERLIN IRON BRIDGE CO.,
EAST BERLIN, CONN.

John Cabot,

553-557 West Thirty-third Street, New York.

Church's Patent
AND
Bolted Trays,
FOR ALL KINDS OF
Gas Purification.

Send for Circulars.

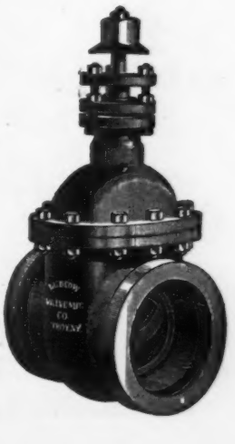


Bristol's Recording
PRESSURE GAUGE.
For continuous records of
Street Gas Pressure.
Simple in construction, accurate in operation, and low in price.
Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

CHAPMAN VALVE MANUFACTURING CO.
MANUFACTURERS OF
Valves and Gates for Gas, Ammonia, Water, Etc.
Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.
Works & Gen'l Office, Indian Orchard, Mass. Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston, Mass.
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St.

THE
Ludlow Valve Mfg. Co.,
TROY, N. Y., U. S. A.
Double and Single Gate Valves, ¼" to 72",
—FOR—
Gas, Water, Steam, Oil, Ammonia, Etc.
HOT GAS VALVES A SPECIALTY.
Send for Catalogue.



AMERICAN GAS COMPANY

Constructors of Coal Gas Apparatus.

KLONNE-BREDEL

Recuperative Furnaces, Washers, Condensers, Purifiers and Purifying Machines, Ammonia Plant, Coke Conveyers, Etc.

Complete Works Erected with Guaranteed Results.

EASTERN AGENTS FOR

FRED. BREDEL'S SYSTEM
COAL GAS PLANTS AND GAS APPARATUS.

P. H. & F. M. ROOTS CO.'S
Exhausters, Blowers, etc.

222 South Third Street, Philadelphia, Pa.

GEORGE G. RAMSDELL, General Manager. **Correspondence Solicited**

FRED. BREDEL, C.E.

Coal and Water Gas Plants.

OWN SYSTEM.

RECUPERATIVE FURNACES, WASHERS, CONDENSERS, PURIFIERS, PURIFYING MACHINES, COKE CONVEYERS, ETC

SOLE UNITED STATES AGENT FOR
ARROL-FOULIS MECHANICAL CHARGING AND DRAWING MACHINES.

Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas

GAS RETORTS AND SPECIAL BLOCKS AND FIREBRICK MANUFACTURED UNDER THE SUPERINTENDENCE OF MY OWN CHEMIST.

COMPLETE GAS WORKS

No. 118 Farwell Avenue, · Milwaukee, Wis

Eastern Agents: AMERICAN GAS CO., Construction Department, 222 So. 3d St., Phila., Pa

ROOTS'

LATEST IMPROVED GAS EXHAUSTER

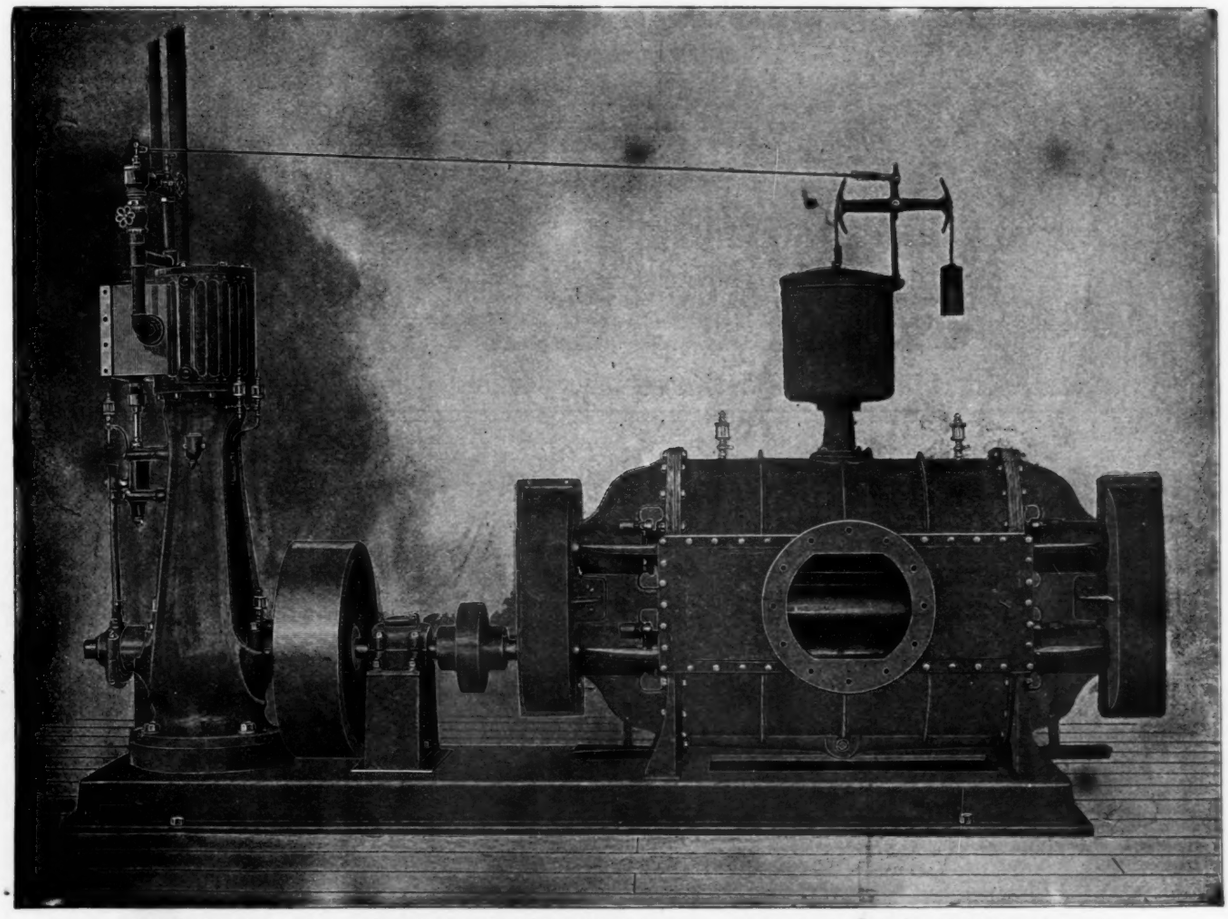
—AND—

NEW GAS GOVERNOR AND STEAM VALVE.

GUARANTEED TO REGULATE WITHIN ONE-TENTH OF AN INCH, WATER PRESSURE.

The Most Perfect Gas Governor on the Market.

MORE DIRECT IN ACTION. FEWER PARTS.
EASIER TO ADJUST THAN ANY OTHER GOVERNOR.



INQUIRIES CHEERFULLY ANSWERED. WRITE FOR CATALOGUE.

P. H. & F. M. ROOTS CO.,

Connersville, Ind. 109 Liberty St., New York.

Eastern Office:

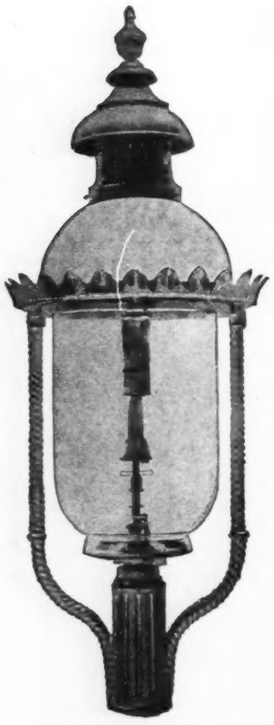
American Gas Company,

222 South Third Street, Philadelphia, Pa.

NEW YORK, 33 Nassau St. PHILADELPHIA, Broad and Arch Sts. CHICAGO, 54 Lake St.

Welsbach Street Lighting Company

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in seventy-five Cities and Towns.

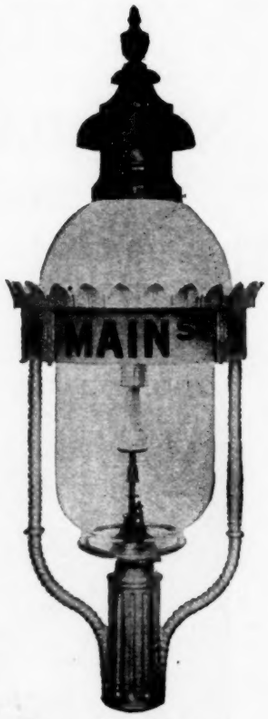
By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.



No. 38.

Correspondence solicited from Gas Companies and others interested in Municipal and outside lighting.

NOW READY.

THE SIXTH (AND CENTENARY) EDITION

— OF THE —

Handbook for Gas Engineers and Managers.

By THOMAS NEWBIGGING, M. Inst. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, - - $6.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, N. Y. City.

PRACTICAL HANDBOOK ON

GAS ENGINES

With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the author by GEO. M. RICHMOND, M.E.

Price, $1.00.

A. M. CALLENDER & CO., 32 Pine Street, New York.

(Copyrighted, 1894, by the AMERICAN METER CO.

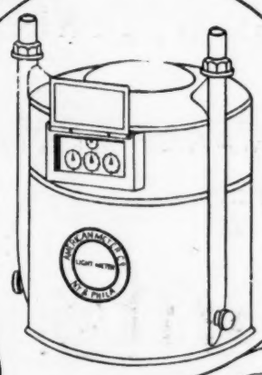
AMERICAN METER CO.

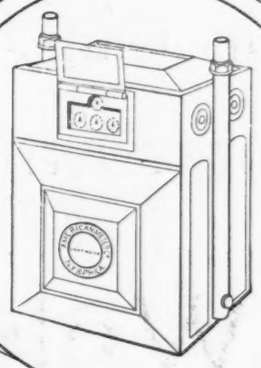
ESTABLISHED 1834. INCORPORATED 1863.

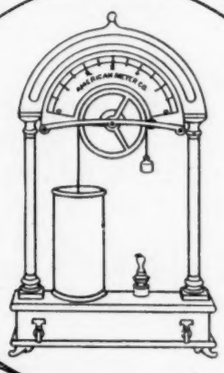
NEW YORK AND PHILADELPHIA,

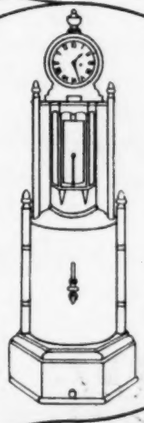
CHICAGO, ST. LOUIS,

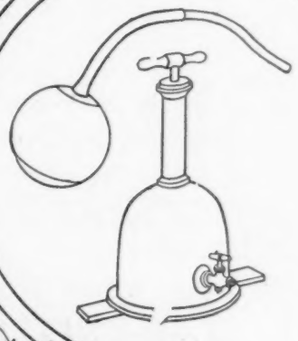
SAN FRANCISCO.

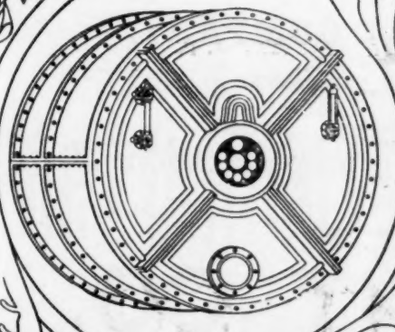


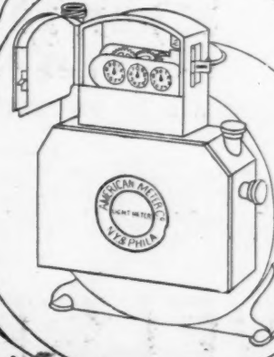












PUBLIC LIGHTING TABLE.

FEBRUARY, 1900.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Thu.	1	5.50 PM	6.10 AM	5.05	6.15
Fri.	2	5.50	6.10	5.05	6.15
Sat.	3	5.50	6.10	5.05	6.15
Sun.	4	10.20	6.00	5.05	6.15
Mon.	5	11.30	6.00	5.10	6.10
Tue.	6	12.40 AM FQ	6.00	5.10	6.10
Wed.	7	1.40	6.00	5.10	6.10
Thu.	8	2.30	6.00	5.10	6.10
Fri.	9	3.20	6.00	5.10	6.10
Sat.	10	4.00	6.00	5.10	6.10
Sun.	11	4.40	6.00	5.10	6.10
Mon.	12	5.10	6.00	5.20	5.55
Tue.	13	No L.	No L.	5.20	5.55
Wed.	14	No L. FM	No L.	5.20	5.55
Thu.	15	No L.	No L.	5.20	5.55
Fri.	16	6.10 PM	9.00 PM	5.20	5.55
Sat.	17	6.10	9.50	5.20	5.55
Sun.	18	6.10	10.50	5.20	5.55
Mon.	19	6.10	11.50	5.30	5.55
Tue.	20	6.10	12.50 AM	5.30	5.55
Wed.	21	6.10	1.50	5.30	5.55
Thu.	22	6.10 LQ	2.50	5.30	5.55
Fri.	23	6.10	3.40	5.30	5.55
Sat.	24	6.10	4.40	5.30	5.55
Sun.	25	6.20	5.30	5.30	5.55
Mon.	26	6.20	5.30	5.30	5.45
Tue.	27	6.20	5.30	5.30	5.45
Wed.	28	6.20 NM	5.30	5.30	5.45

TOTAL HOURS LIGHTING DURING 1900.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	230.50	January	423.20
February	175.40	February	355.25
March	189.00	March	355.35
April	160.30	April	298.50
May	150.40	May	264.50
June	137.00	June	234.25
July	152.00	July	243.45
August	171.50	August	280.25
September	187.20	September	321.15
October	213.10	October	374.30
November	221.50	November	401.40
December	231.50	December	433.45
Total, yr.	2221.40	Total, yr.	3987.45

THE RECENT DECISION.

The United States Circuit Court of Appeals,

In Its Opinion of December 7, 1899,

FINALLY AND FULLY SUSTAINS THE WELSBACH COMPANY'S PATENT.

DEALERS and USERS and MANUFACTURERS are CAUTIONED against INFRINGEMENT of the

Welsbach Patents.

Judge LACOMBE, in the United States Circuit Court, handed down the following opinion Saturday, Dec. 9, 1899.

On motion to restrain complainant from sending circulars to the customers of American Incandescent Lamp Company.

LACOMBE, Circuit Judge.

Irrespective entirely of the preliminary objection that affirmative relief of this sort will not be granted to defendant—a question not now passed upon—there seem no good grounds for criticism of complainant's circular. It states that Judge Townsend enjoined the "manufacture and sale" of infringing mantles, and he did grant such an injunction. And this Court has enjoined the sale of mantles which the person enjoined did not himself manufacture, when his past conduct in the matter of infringement created a special equity in favor of the complainant against him. It is true that the circular goes further, and threatens suit against persons who sell mantles, but who never have been at all concerned in manufacturing or causing them to be manufactured.

In other words, it threatens suit upon the patent as if it were a patent for a product. But the complainant insists that the threat is made in good faith; that it intends to bring suits against sellers of the infringing mantles upon the theory that the patent is really one for a product. In view of the peculiar language of the claim, this Court is not now prepared to hold that such contention would be wholly without merit, or that the complainant could not succeed against a mere seller. Moreover, it is contended that the seller of a purchased mantle himself promotes the taking of the final step in the process, and such contention has not yet been passed upon adversely to complainant. These are questions which should be left to be determined in one of such suits, rather than here. If complainant intends to prosecute one or more sellers, and there is nothing before the Court to induce a disbelief in its assertion that it does so intend, it would seem to be its proper course to warn dealers to desist from selling.

December 9, 1899.

Restraining orders issued in the United States Circuit Courts against—

THE UNITED INCANDESCENT LIGHT COMPANY.
ST. LOUIS INCANDESCENT MANTLE COMPANY.
ECKERLE ELECTRICAL COMPANY.
H. KUPFER.
THE NEWBY INCANDESCENT MANTLE COMPANY.

All infringers will be prosecuted, whether Manufacturers, Dealers or Users.

TO THE PUBLIC: Avoid Liability of infringement! Take nothing but the GENUINE always in sealed boxes bearing our registered trademark, "WELSBACH."

WELSBACH LIGHT CO.

Salesrooms in all the leading cities throughout the United States.

THE UNITED GAS IMPROVEMENT COMPANY.

THE STANDARD JUNIOR,

THE STANDARD DOUBLE SUPERHEATER,

LOWE WATER GAS APPARATUS.

Total Sets Installed to January 1, 1900, - - - - - - - - 327

Total Daily Capacity - - - - - - - - - 207,425,000 Cu. Ft.

WATER GAS PLANT AS AUXILIARY TO COAL GAS WORKS.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY Prest. DAVID R. DALY V. Prest. & Treas.
H. D. ABERNETHY. Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

E. D. WHITE, President. A. H. GUTKES, Vice-President. H. A. PERKINS, Secretary.

Brooklyn Fire Brick Works,

MANUFACTURERS OF

CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.

Office, 88 Van Dyke St. Brooklyn, N. Y.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { CAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Exclusive Agents for

The Mitchell Half-Depth Regenerative Furnace.

This is the *original* coal-consuming Furnace for Retort Benches. Burns either Coal or Coke. Full and Half-Depth Regenerative Furnaces for Benches of 6's, 7's, 8's or 9's erected complete.

Proprietors of the Coze System of Inclined Retorts.

Office: 901 Pine St., **St. Louis, Mo.**

The Construction of Gas Works

PRACTICALLY DESCRIBED,

By WALTER RALPH HERRING.

Price $2. For Sale by

A. M. CALLENDER & CO.,

32 Pine Street, N. Y. City.

Adam Weber,

Proprietor,

Manhattan Fire Brick and Enameled Clay Retort Works.

Works, Weber, N. J.

Office, 633 East 15th St., New York.

Modern Recuperative Furnaces

And Standard Fire Brick and Gas Retorts

Works, LOCKPORT STATION, PA.

—ESTABLISHED 1864.—

JAMES GARDNER, JR.,

Successor to WILLIAM GARDNER & SON

Hamilton Building, Fifth Avenue, PITTSBURGH, PA. P. O. Box 373.

Fire Clay Goods for Gas Works.

SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg or Mount Vernon.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

Eastern Agent, PERRY BORDEN, 19 Prospect Ave., MOUNT VERNON, N. Y.

Parker-Russell Mining and Mfg. Co.,

CITY OFFICE,

417 Pine Street, St. Louis, Mo.

PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT BALTIMORE MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Red and Buff Ornamental Tiles and Chimney Tops. Baker Oven Tiles 12x12x2 and 10x10x2.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

PRACTICAL PHOTOMETRY.

A Guide to the Study of the Measurement of Light.

By WILLIAM JOSEPH DIBDIN.

With Numerous Illustrations Price, $3.00. A. M. CALLENDER & CO., 32 Pine Street, N. Y. City

National Gas and Water Company.

CONTRACTORS FOR
Gas Plant Machinery

SOFT COAL OR COKE
WATER GAS GENERATORS
A SPECIALTY.

218 LA SALLE ST.,
CHICAGO.

Gas Engineers
INSPECTION AND ADVICE.

PLANS AND ESTIMATES
FOR IMPROVEMENTS OR
REPAIRS.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)
MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

AUTOMATIC GOVERNOR.
OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT!
WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION!
REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE!
IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 357 Canal St., New York.

Hughes' "Gas Works,"

Their Construction and Arrangement,

And the Manufacture and Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E.

Rewritten and Much Enlarged by
WM. RICHARDS, C.E

Eighth Edition, Revised, with Notices of Recent Improvements.

Price, $1.65.

A. M. CALLENDER & CO.,
32 Pine St., N. Y. City.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER,

FOR USING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for triai.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY

H. E. PARSON, Supt., 457 Putnam Ave., Brooklyn, N. Y

The Chemistry of Illuminating Gas.

By NORTON H. HUMPH Price, $2.40.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

The Gas Engineer's Laboratory Handbook.

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 32 Pine Street, N. Y City.

Practical Hints on the Construction and Working of Regenerator Furnaces,

By MAURICE GRAHAM, Assoc M. Inst. C E.

Price, $1.25. For Sale by

A. M. CALLENDER & CO., No. 32 Pine Street, New York City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

SCIENTIFIC BOOKS.

GAS MANUFACTURE, THE CHEMISTRY OF, by W. J. A. Butterfield. $3.50.

NEWBIGGING'S HANDBOOK. By Thos. Newbigging. 6th edition. $6.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1898. $5.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor. $3.50.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

CHEMISTRY OF ILLUMINATING GAS. By Norton H. Humphrys. $2.40.

PRACTICAL TREATISE ON HEAT By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*. $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

GAS WORKS: Their Arrangement, Construction, Plant and Machinery. $5.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfield. $1.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

OAL: Its History and Use. By Prof. Thorpe. $3.50.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

GASFITTER'S GUIDE, by John Eldridge 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2

CONSTRUCTION OF GAS WORKS, by Walter Ralph Herring. $2.

DIGEST OF GAS CASES. $5.

PRACTICAL HINTS ON REGENERATOR FURNACES By M. Graham. $1.25.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

GAS LIGHTING AND GAS FITTING. By W. P. Gerhard. 50 cents.

PRACTICAL PLUMBING. By P. J. Davies. $3.

AMERICAN PLUMBING. By Alfred Revill. $2.

CEMENT; A Manual of Lime and Cement, their Treatment and Use in Construction. By A. H. Heath. $2.50.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKETBOOK. By Monroe and Jamieson. $2.50.

MAGNETISM AND ELECTRICITY. By J. Overend. 40 cts

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 32 Pine Street, New York.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point Baltimore, Md.
OFFICE, - 640 Equitable Building Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. — *AGENTS.* — BANGS & HORTON, 60 Congress St., Boston.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50. For sale by

A. M. Callender & Co., 32 Pine St., N. Y.

GREENOUGH'S "DIGEST OF GAS CASES."

Price, $5.00.

This is a valuable and important work, a copy of which should be in the possession of every gas company in the country, whether large or small. As a book of reference it will be found invaluable. It is the only work of the kind which has ever been published in this country, and is most complete. Handsomely bound. Orders may be sent to

A. M. CALLENDER & CO., 32 Pine St., N. Y.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River: Pier No. 1 (Lower Side), South Amboy, N. J.

EDMUND H. McCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.

Crude Oil, Gas Naphtha,
Refined Petroleum, Gas Oil.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

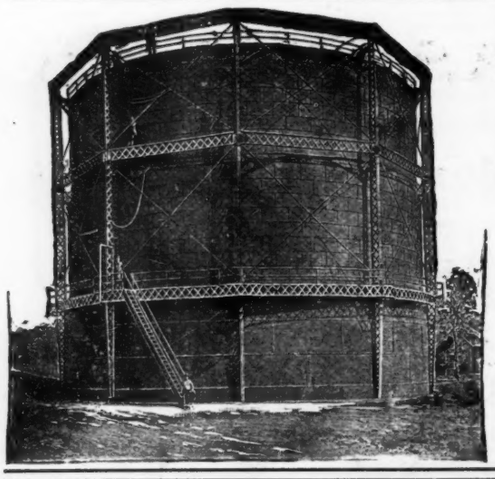
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,
WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Borrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,
CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

OMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

CORRESPONDENCE SOLICITED.

OFFICE : WAYNE COUNTY BANK BUILDING, Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,
Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

BREVARD, N. C.

Geo. Shepard Page's Sons.
GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

JAMES T. LYNN,
GAS ENGINEER AND CONTRACTOR,

Wayne Bank Building, - DETROIT

GAS PROPERTIES PURCHASED.

DAVID LEAVITT HOUGH,
Consulting Engineer AND CONTRACTOR,

374 FIFTH AVE., N. Y.

Kerr Murray Manufacturing Company,
Steel Gasholder Tanks,
SINGLE, DOUBLE AND TRIPLE-LIFT GASHOLDERS,
HORIZONTAL AND VERTICAL STORAGE OIL TANKS

Iron Work for Coal Gas Benches, Self-Sealing Mouthpieces, Exhausters, Condensers, Scrubbers, Purifiers, Wooden Trays, Floor Carriages, Center Seal and Valve System Connections, Cast and Wrought Iron Fittings, and Connections 3 to 36 Inches Diameter.

VALVES, Double Gate, Hub and Flange, Outside Screw and Quick Opening, 3 to 36 In. Diam.

COAL AND COKE WAGONS, RETORT HOUSE TOOLS, STREET MAIN SPECIALS AND DRIPS.

Address,

KERR MURRAY MANUFACTURING CO.
Fort Wayne, Indiana

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double and Single-Lift Gasholders.

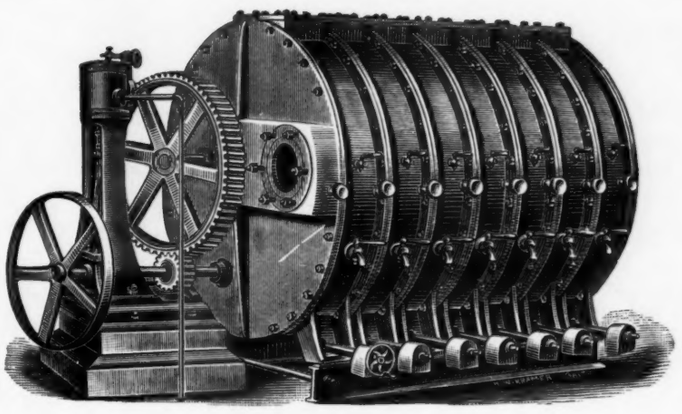
Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS

PURIFIERS.



CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS

Boilers.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSIBLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.

ALEX. C. HUMPHREYS, M. E., M. nst. C. E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG.,
31 Nassau Street,
New York.

9 VICTORIA STREET
London, S. W.,
England.

CONSULTING GAS ENGINEERS
AND MANAGERS.
GAS PROPERTIES PURCHASED.

GASHOLDER TANKS AND
GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND.

Formerly with the Continental Iron Works.

Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

Foundries and Works: { Millville, N. J. / Florence, " / Camden, "

R. D. WOOD & CO.

ENGINEERS, IRON FOUNDERS, MACHINISTS

400 Chestnut Street, PHILADELPHIA, PA.

MANUFACTURERS OF

Cast Iron Pipe.

SOLE MAKERS OF

THE MITCHELL SCRUBBER

(PATENTED.)

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

BUILDERS OF

Gas Holders.

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

CUTLER'S PATENT FREEZING PREVENTER For Gas Holder Cups.

THE TAYLOR REVOLVING BOTTOM GAS PRODUCER.

HEAVY LOAM CASTINGS, DUNHAM SPECIALS, HYDRAULIC WORK, LAMP POSTS, VALVES, Etc.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

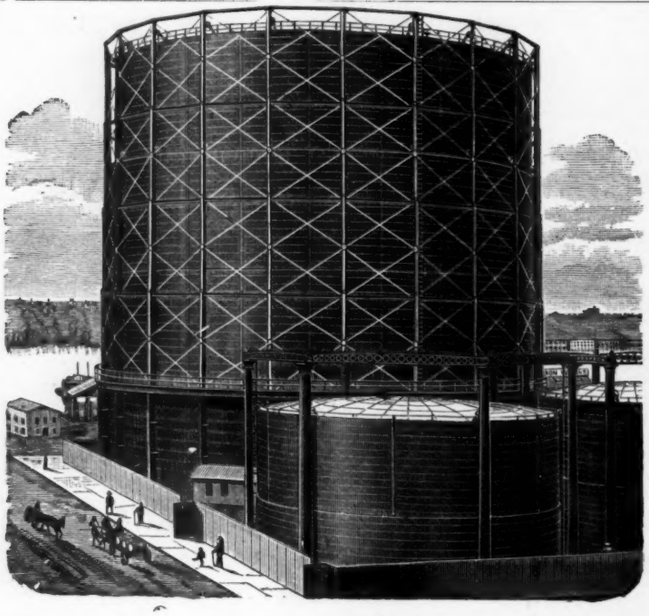
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. OFFICES Bridge & Ogden Sts., Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cuttlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

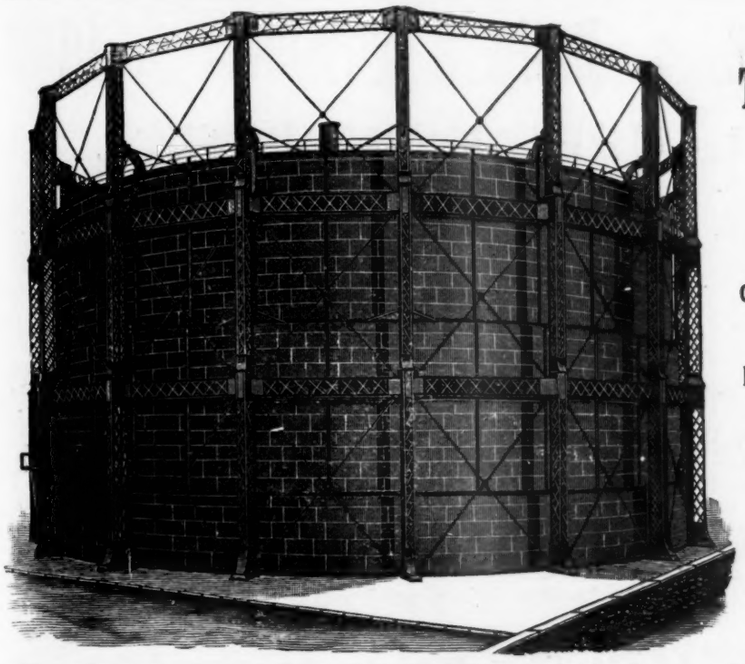
BURDETT LOOMIS, - - Hartford, Conn.

To Gas Companies.

We make to order CAP BURNERS to burn any amount under a stated pressure. Send for samples.

Also SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,
248 N. 8th St., Phila., Pa.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr.
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO.

Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

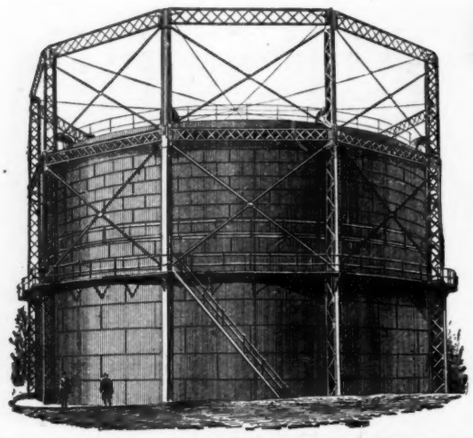
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited. Plans and Estimates Furnished.

1899 DIRECTORY 1899

OF AMERICAN GAS COMPANIES

Price - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.



1842 ※ Deily & Fowler, ※ 1900

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

James R. Floyd's Sons,

FREDERICK W. FLOYD, President.
HENRY E. FLOYD, Vice-President.
JAMES R. FLOYD, Jr., Sec'y & Treas.

531 to 543 West 20th Street and 530 to 540 West 21st Street, N. Y.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF

All Kinds of Castings and Iron Work for Gas Apparatus.

ESTABLISHED 1856.
INCORPORATED 1899.

Write for Estimates to
539, West 20th St., New York City.

LOGAN IRON WORKS,

Brooklyn, N. Y.

BUILDERS OF

GASHOLDERS

Oil Tanks, Water Tanks, and General Wrought Iron Work.

1899 brought to us the Largest Number of Gasholder Contracts of any year in our history. Work was erected abroad as well as in many States of the Union, covering points separated by thousands of miles.

PLANS AND SPECIFICATIONS FURNISHED AND CORRESPONDENCE SOLICITED.

BINDER for the JOURNAL.

Price $1.00.

A. M. CALLENDER & CO., 32 Pine Street, N.Y.

—THE—

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

SECOND EDITION.

By THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

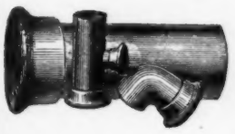
Price $2. For Sale by

A. M. CALLENDER & CO.,
32 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches. Bends, Retorts, etc., etc

"GLOBE" SPECIALS, VALVES, ETC. "LANORGAN" FIRE HYDRANTS

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON

FLANGE

GAS and WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

Western Office: Monadnock Block, Chicago, Ills.

GEORGE ORMROD, Manag. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Price, $3. For Sale by

A. M. CALLENDER & CO., 32 PINE ST., N.Y. CITY.

The Gas Engineer's Laboratory Handbook.

By JOHN HORNBY, F.I.C. Price, $2.50.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 50,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

511 West Twenty-first Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | 34 & 36 West Monroe Street, CHICAGO.

Established 1849. With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS METER CO.,

8 Medford Street, Boston, Mass.

MANUFACTURERS OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Prepayment Gas Meters.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 107 West Monroe St.**

SAN FRANCISCO, 221 Front St.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

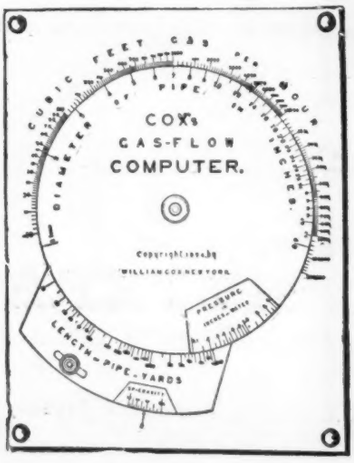
"Perfect" Gas Stoves

A PERFECTLY ACCURATE METER
AN ALWAYS-TO-BE-DEPENDED-ON METER
A BEST-MADE METER
A SURE-TO-PLEASE METER

THE KEYSTONE METER

Made at ROYERSFORD, PA.

Pacific Coast Supplied by WIESTER & CO., 17 & 19 New Montgomery St., San Francisco, Cal.



Do you wish to Know

what size of Pipe to use to convey any quantity of Gas, any distance, with any loss of pressure, and any initial or final pressure? Then use

COX'S GAS FLOW COMPUTER,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.

For sale by

A. M. CALLENDER & CO., 32 Pine St., N. Y. City.

American Meter Co.

NEW YORK, PHILADELPHIA,
SAN FRANCISCO.

Prepayment Meters.

Their construction is such that they may be readily readjusted when the scale of gas rates is changed.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

THEODORE D. BUHL, President. CHAS. H. JACOBS, Secretary-Treasurer.

DETROIT METER COMPANY,

DETROIT, MICH.

MAKERS OF...

GAS METERS.

OUR equipment embraces the Latest and Most Improved Machinery. We make our own Tin Plate. We claim for "BUHL" METERS, **Increased Durability,** with probability of **Fewer and Less Expensive Repairs,** and **More Accurate Adjustment.** Comparisons invited. Meters of other Makers promptly Repaired.

MAIL ORDERS SOLICITED.

The Advertisement of

JOHN J. GRIFFIN & CO., Mfrs. of Gas Meters, etc.,

Nos. 1513, 1515, 1517, 1519 & 1521 Race Street, Philadelphia,

52 Dey Street, New York, 75 N. Clinton Street, Chicago,

Occupies this space every alternate week.

THE WESTERN GAS CONSTRUCTION CO., FORT WAYNE, IND.

IMPROVED

COAL GAS APPARATUS,

COMPLETE SYSTEM OF

Exhausters, Condensers, Tar Extractors, Washers, Scrubbers, Tar Separators and Ammonia System,

For the Complete Progressive Treatment of the Gas from the Retort Outlet to the Purifiers.

PURIFICATION.

Ordinary Purifiers and 4-way or Valve Systems. IMPROVED DUPLEX and TWIN PURIFIERS with DUPLEX VALVE for obtaining the maximum efficiency of apparatus and economy in handling materials on minimum capital expenditure.

Coal Gas Bench Castings.

Steel Hydraulic Mains, Self-Sealing and Common Mouthpieces, Steel Tanks, Riveted Steel Pipe, Steel Roofs and Buildings, Street Main Specials, Ammonia Apparatus, Tar Distilling Plants, Rotary Washers, Street Main Governors.

VALVES.

Our PATENTED DESIGN, especially suitable for FOUL MAINS, for Street Mains and Works use. Can be opened, inspected, cleaned and repaired while in place.

Improved Lowe Water Gas Apparatus.

Original Installations and Auxiliary Plants and Designs for Special Situations. All capacities. Over 70 plants installed and in successful operation.

WILLIAM HENRY WHITE,
EASTERN ENGINEER,
32 Pine St., New York.

The Western Gas Construction Co.,
FORT WAYNE, INDIANA.